MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for December, 1897, is based on 2,916 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,567 from voluntary observers; 96 received through the Southern Pacific Railway Company; 23 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are generally corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. DUNWOODY, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold wave," and "norther," respectively.

The following notes have been collected.

No very severe or destructive storms occurred during the month.

The injurious weather conditions of most marked note were the frosts and freezing weather that occurred in the citrus fruit districts of California on the 2d and 3d and from the 16th to the 22d, inclusive. On the former dates the temperature fell to considerably below freezing as far south as Los Angeles and Riverside counties, but the injury to the fruit interests was probably small. Concerning the latter period, Mr. W. H. Hammon, forecast official, in charge of the Weather Bureau office at San Francisco, reports:

Beginning with Wednesday night, December 15, and continuing until December 22, inclusive, temperatures at least approximating and in some places falling below the danger point were experienced in the citrus regions of California. On the nights of December 15, 16, and 17 probably no injury resulted, although it will be observed that the Riverside Press on December 17 records a temperature of 26° and states that extensive efforts at protection were employed. On Saturday a very slight depression moved southward across southern California, which had probably been moving from the northeast across Utah and southern Nevada during the two days previous. This caused light showers in southern California, followed by clearing weather and north winds Saturday night. In some sections in the vicinity of Ontario and Pomona the wind ceased, so as to allow serious frost Sunday morning, the temperature falling to 21° and 24° in low places. The most injurious frost was Sunday night, December 19, when the temperature in Redlands, San Bernardino, and Riverside varied in places from 21° to 32°. On the nights of the 20th and 21st almost as severe frost occurred, which probably increased the injury, owing to the continuation of the cold.

From no section has as full and reliable information been received regarding the severity of the frost as from Riverside, and the lowest record that I have been able to find from that section is 22°, and that well down on the side of an arroyo. The temperatures, as a rule, ranged between 24° and 28° in sections in which in December, 1895, they ranged from 20° to 24°. The temperatures recorded at Pomona, San Bernardino, and Redlands this year were as low as those recorded in 1895.

It is difficult to determine the extent of the injury in the citrus region. In northern California the crop was nearly all marketed, and the greater portion of that still on the trees was picked after the warning was received, and consequently the injury was slight. In southern California the Los Angeles Express places the injury between 10 and 20 per cent; the Riverside Press, from 15 to 25 per cent; and the Los Angeles Herald, at one-third of the crop. Probably the estimate of the Riverside Press is the most nearly correct.

Warnings of these frosts were issued by the Weather Bureau in every instance on the morning of the day preceding their occurrence.

On the morning of the 2d the forecasts for the following day were: "For northern California, decidedly colder to-night, with killing frost; smudging necessary for citrus fruits. For southern California, killing frost, injurious to citrus fruits; smudging necessary." On the morning of the 3d the forecasts were: "For northern California, heavy frosts to-night. For southern California, killing frost to-night."

Concerning the forecast of the 2d, Mr. Hammon reported that it was somewhat more severe than was warranted, but that he preferred to have the error made in that direction rather than that a serious frost should occur without a sufficient warning being given, as the expense of protection was slight in comparison with the injury that would result without protection.

On the morning of Wednesday, the 15th, forecast was made of killing frost for Thursday, the 16th, with "some danger to citrus fruit Thursday night," and a similar forecast was repeated daily until Saturday, the 18th. From Saturday evening, the 18th, to Wednesday, the 22d, the forecast read, "killing frost, probably injurious to citrus fruit." These warnings were given the most complete and effective distribution possible throughout the threatened regions. All persons receiving forecasts on the daily forecast card received these warnings. The telephone company distributed them to every exchange in the State, and the Southern Pacific Company and San Francisco and San Joaquin Valley Railway Company notified all their agents.

The benefits of these warnings to the fruit growers in enabling them to secure large quantities of the crop before it was harmed and to protect the remainder from injury is universally admitted to have been immense. It is stated that nearly every large orchard is now provided with excellent means for preventing or diminishing injury from frost, and undoubtedly every possible means of protection was used in these instances. It was probably due in a measure to this protection that so little injury resulted from the frosts of the 3d and 4th, and the value of the fruit saved from damage through these means during the freezing weather of the 16th to 22d is estimated at approximately a million dollars.

It is thought reasonable to believe that the fact that the temperatures reported from Riverside during this freeze were on the average about 4° higher than those of 1895, while the temperatures reported from Pomona, San Bernardino, and Redlands were about the same as in 1895, was due largely to the more extensive use of protective measures in the first-named district.

The freeze had the effect of drawing increased attention to and putting to practical test the various means of protection that have been heretofore suggested or devised, and also of arousing a general interest in and discussion of the region, climate, and conditions best adapted to the successful culture of citrus fruit. Among the means of protection used at this time may be mentioned the burning of moist straw, or "smudging," steam apparatus, water spraying, baskets of burning coal, and buckets of burning oil and tar. The last-named method was claimed in one instance to have raised the temperature of the orchard where it was used 5° above that of the surrounding locality.

Suggestion was made that the general protection of fruit from injury by cold was a matter of such public interest and involved so great expense and such extensive preparation and cooperation that it might be justly made a public charge and provided for by a tax levy.

Investigations were made as to the temperature inside and outside the fruit at which injury began, with the result of fixing the former at from 31° to 28°, and the latter at from 26° to 24°.

Several experiments were made with the X rays, in order to determine from the photographs whether the fruit had suffered injury or not.

From many articles on this subject in the public press the following are selected:

Los Angeles, Cal., Daily Herald, December 2, 1897.—A killing frost and stiff northerly winds are predicted for southern California to-night. A heavy storm and a cold wave prevailed in Utah and Nevada yesterday, and southern California will not escape, as the atmospheric disturbance is traveling this way.

The Weather Bureau announced the frost early yesterday, thirty-six hours in advance of the arrival of the vegetation destroyer. The orange and lemon growers and others whose products are liable to injury are thus warned in ample time to take steps for the protection of their crops. To-day should be a busy day with them. Of course the whole of southern California will not be affected alike, but precautions should be taken at all points where there is danger of a killing frost.

The prediction of frost so far in advance of its coming shows that the weather service has taken great strides forward in recent years. It pays for itself many times over in thus giving warning of storms, frost, and other elemental disturbances. It often occurs nowadays that ships put out to sea or remain in port in accordance with the suggestions of the Weather Bureau, thereby escaping danger and possible loss. A single warning of this kind has saved millions of dollars in property on the Atlantic coast.

San Bernardino, Cal., Sun, December 3, 1897.—The message that was sent from the Weather Bureau Wednesday, announcing a heavy killing frost for Friday morning, caused consternation throughout the whole citrus belt of southern California. It meant danger to millions of property at a time when the loss would come heavy on the fruit grower. The orange crop this season is exceptionally large and the prices good. A freedom from frost would lift the burden from hundreds of struggling horticulturists, while a frost means disaster to them.

Yesterday afternoon the Southern Pacific Company sent out to all their agents and conductors strict orders to sound the alarm to every place on their lines throughout the State and disseminate the news as broadcast as possible through the following dispatch:

"All agents. Weather Bureau forecast: Cold weather and killing frosts in Sacramento and San Joaquin valleys to-morrow, Friday, morning. Also killing frosts in southern California orange sections and a few miles back from coast. The bureau recommends smudging of all orange groves to-night to prevent great loss. Advise all conductors so they may notify and spread this information."

The first warning came twenty-four hours in advance and was heeded throughout the whole valley. The thermometer was closely watched by hundreds of anxious people all last night to notice each change for the worse. At 6 p. m. last evening it marked 42°.

At midnight the mercury had dropped to 30°, when a slight warm wind came from the southwest and the thermometer rose rapidly, and at 2 a. m. it stood at 36°, and the danger was over.

There are many ways of diminishing the danger from frost practiced by the orange grower. To turn on the irrigating water through the orchard is a great help.

In the Everest orchard of Riverside, along the upper side, is a series of large tanks filled with crude petroleum. From each one runs a pipe down through the orchard, with laterals. From the latter fine streams of oil drop into iron kettles, and when lighted the orchard is warmed and smudged at the same time. It is claimed that the temperature can be raised in this way from 8° to 12°. Many growers place windrows of hay through every other row of trees, and dampen it, so it will send up a cloud of steam and smoke burning slowly. This is an excellent way to keep off the frost and is very successful.

Coal tar in vessels, when set on fire, throws up a dense smoke. This is good, but it affects the fruit, giving it a smudge that needs to be cleaned off before packing the fruit.

A wire screen with a fire underneath and wet straw or coarse, damp manure on top is said to be excellent to raise a steam and smudge.

There are a dozen other ways to keep the frost at bay, the main idea being to raise an artificial cloud that will prevent the moisture from settling on the fruit and turning to frost there. A slight breeze is a sure preventive. In Rialto there is scarcely a night in the year but there is a breeze sweeping over it, and frost to damage oranges has hitherto been unknown there.

San Francisco, Cal., California Fruit Grower, December 25, 1897.—The citrus fruit-growing districts of California have lately experienced the effects of a cold wave of unusual length. The daily weather map and bulletin of the United States Department of Agriculture bearing date Wednesday, December 15, over the name of W. H. Hammon, forecast official, in charge, had this for southern California: "Fair to-night and Thursday; colder to-night, with frost in the interior; some danger to citrus fruit Thursday night." Every day since then, up to and including December 21, the forecast for that section has been for injurious frosts, but worded more strongly.

San Francisco, Cal., Call (editorial), December 22, 1897.—So much criticism, both flippant and caustic, is visited upon the Weather Bureau

whenever it makes a mistake in forecasts that it is only fair commendation should be given when by some conspicuous act of useful service it demonstrates its value to the community. Such service it has just rendered in giving warning to the orange growers of the coming of the cold snap, thus enabling them to prepare in time for guarding, as far as possible, against injury by frosts.

It is yet too early to venture upon estimates of the amount of damage done by frosts, or to calculate how much was saved in the orchards where the growers smudged or resorted to other devices to keep the temperature of their orchards above the danger point. Enough is known, however, to make it certain that the loss in some localities has been very great, and that it would have been greater but for the warning sent by the Weather Bureau.

Taking all things into consideration, there is probably no department of the public service in which the Government renders so much benefit to the people in proportion to its cost as the Weather Bureau, and the value of the service increases with each succeeding year. It would be more valuable if the people understood better how to profit by its warnings. For that reason it is to be desired that some data be gathered of the results obtained from the various means of guarding against frost in the present instance, so that the best method of avoiding the danger in future may be made known.

Albany, N. Y., Press and Knickerbocker, January 3, 1898.—A practical demonstration of the value to agriculturists of the bulletins of the Weather Bureau was given last week in the fruit-growing districts of southern California. Extreme cold was predicted in Los Angeles, Riverside, and Bernardino counties, and, in fact, the mercury fell to 10° below freezing, the lowest temperature registered in that part of the country for twenty-five years. With ripe and ripening oranges on the trees this would have meant, but for the hoisting of the danger signal, a complete loss of the fruit. Careful estimates show the quantity of fruit ready for marketing thus put in jeopardy to have been 10,000 carloads, or 2,000,000 boxes, amounting in value, at $3 a box, to $6,000,000. About one-fifth of the crop is supposed to have been gathered in at the first warning of the Weather Bureau, and the dilatory or skeptical owners of the other four-fifths doubtless wish that they had reposed greater trust in the official meteorologists.

Sacramento, Cal., Record Union, December 23, 1897.—Whatever poking of fun may have been indulged in in the past at the expense of the Weather Bureau service, and there has been all too much of it, it must be conceded now that the Bureau has in the recent service in this cold spell been accurate and of greatest benefit to the people of the whole of this coast. The fact is that the Bureau, as a rule, has been all along accurate in its forecasts. We are prone to find fault with it when, like all human institutions, it has been in error, while we are not given to awarding full credit for all its beneficence when reliable and correct. For that it is a good doer, whoever is honest and just must admit. The American people have every reason to be proud of the Weather Bureau, and to be satisfied with the service it gives the country. Let those who have carped and complained pause long enough to contemplate the blotting the service from our system. Let them reflect upon what would be the result of being deprived of that which has now become so much more than a convenience, a necessity.

Los Angeles Sunday Times, December 26, 1897.—The facts about the citrus fruit industry in southern California are no longer difficult of comprehension. They are, indeed, so plain that "he who runs may read."

When, twenty-five years ago, orange trees were first planted in this section on a commercial scale, little or nothing was known by the pioneers of the industry regarding the proper conditions attendant on the planting and cultivation of citrus fruit. Quite naturally orange groves were planted on the level lands, where the necessary water for irrigation was available. Hence, we find that a majority of the older groves are the worst damaged whenever a severe frost occurs.

The true citrus belt of this continent, on the Pacific coast, extends from the latitude of Santa Barbara, on the north, southward, through southern California and Mexico, to Central America. It is here narrow, there wide, according to local conditions. Even within the limits of a quarter of a section of land there may be local climatic conditions which must be studied.

North of the Tehachapi range are, here and there, narrow sheltered strips of land in the foothills, upon which citrus fruit may be raised with fair prospect of success, in ordinary seasons, even as far north as Butte County, but the farther north one goes the smaller is the area of such lands, and the greater the care which must be exercised in planting orange or lemon groves.

The fact is that the whole of southern California is on the northern edge of the true citrus belt of the Western Hemisphere, and we must govern ourselves accordingly. Those who, influenced by enterprising real estate agents or by inadvertence, plant citrus trees outside of the safety line must be content to take their chances. The area of safe citrus land in southern California, while in the aggregate quite important, bears only a very small relation to the total area of the seven southern counties, and from year to year Jack Frost defines his boundaries more plainly. All who are interested in the permanent prosperity of this section should see to it that strangers are not led to delude themselves on this score.

It would well pay the citrus fruit growers of southern California to club together and buy the orange and lemon groves that have been planted in localities visited by damaging frosts every two or three years, cut down the trees, and replant the land with some tree or crop more adapted to the climate.

Los Angeles Daily Times, December 22, 1897.—In this connection it might be well to note certain experiments which have been made this year. At Pomona tests have been made by a representative of The Times, and by J. W. Mills of the Experiment Station, to determine the degree of cold requisite to congeal orange juice. It was found that at a temperature of 28° in the interior of the orange, which had occurred three times during December, and which is the lowest temperature yet found, the juice showed the presence of ice, though water congeals at a temperature of 32°. Mr. Mills, however, placed open dishes of water and orange juice side by side, and determined that ice was present in the juice before the water froze, but in the juice it was in the nature of floating crystals, not all the juice congealing, while the water eventually froze solidly. This would indicate that an orange might be frozen sufficiently to burst the juice cells without this being evident to the eye when cut open.

The effect of frost on oranges is to burst the juice cells, leaving the juice to float through the fruit, from which in time it is either drawn back into the tree, or finds its way through the pores of the rind and evaporates. In the course of time, which is hastened by warm weather, the fruit becomes flabby and light in weight, while eventually spots appear upon the rind, indicating the beginning of decay. If immediately picked, this fruit can be sent to market and consumed without attracting attention, and there is no reason to believe that, as long as it is firm and of practically normal weight, it is unwholesome. But when, in the course of about two weeks, the fruit becomes flabby and juiceless, it is neither palatable nor wholesome. It is not always easy to determine whether an orange is seriously injured or not. If only a few of the cells are broken, the orange will lose but slightly in weight, the loss in weight increasing in proportion to the loss of juice. A box or oranges naturally weighs about 70 pounds. If it falls to 60 pounds it may still rank as good fruit, though not fancy, while if it drops to 50 pounds it is undoubtedly not a wholesome food. As a single tree may contain sound fruit, fruit that is badly frozen, and fruit in all intermediate stages, and as the condition of the fruit can only be determined by weight as the expert packers handle them, it is evident that, even in view of great care, some of the comparatively light fruit must be marketed.

On the other hand, when a grower sees his crop injured, his desire to save himself as far as possible from loss often prompts him to pick and market the oranges as rapidly as possible, and it has been the case following previous frosts that the shipments reached an abnormal condition immediately after the frost, while those who had gilt-edge fruit would not market it in view of the certainty of a demoralized market. These shipments rarely bring returns of consequence, as the fruit is generally known to be frosted and the market breaks under the pressure. Whether that will result this year is doubtful. It is certainly to be hoped that no inferior fruit will be sent out.

If the oranges are not picked after the frost, in the course of a month nature begins to segregate the sound fruit from that which is frozen, by throwing the latter to the ground; and, so far as the frosts of this month are concerned, it can be said that when the market rallies from the holiday trades, about February 1, it will be too late to receive any oranges which are badly frozen, as they will then be on the ground.

Eastern dealers and consumers need have no suspicion of oranges which reach them under the brand of fancy fruit. The packers have labored for years to build up a reputation for their brands, and while it is possible that some frosted fruit will find its way to market, it is certain that no reputable house will ship such freight under a brand which has a reputation with eastern dealers.

The fact that the frost has trodden paths where its footprints were discernible before simply once more emphasizes the necessity of adapting the cultivation of the soil to the climate and other conditions which prevail.

Los Angeles, Cal., Daily Herald, December 24, 1897.—There is another view of the case that must not be lost sight of. These occasional cold waves have served to demonstrate the fact that there are warm belts and there are cold belts throughout the State. The lowlands are subject to damaging frosts, while the higher slopes of the valleys, nearer the mountains or foothills, are not subject to damaging frost. Years ago this fact was not so well known as it is to-day. The lowlands were more easily irrigated than the higher slopes, and hence they were, as a rule, the first to be planted. Hence, many of the first orange orchards in southern California were planted in localities where no one would to-day think of planting either the orange or the lemon tree. As the people realized the fact that the higher slopes of the valleys were comparatively free from frost, they began to plant their citrus trees on those slopes.

FREEZING WEATHER IN THE TEXAS SUGAR AND VEGETABLE REGIONS.

Freezing temperatures occurred in the sugar and vegetable

regions of Texas on the 3d and 4th, concerning which Dr. I. M. Cline, local forecast official and section director in charge of the Weather Bureau Office at Galveston, reports:

As the a. m. weather map of Thursday, December 2, 1897, showed very unsettled conditions and the possibility of temperatures injurious to sugar and trucking interests in this section during Friday, noon special observations were called for from authorized stations in Texas, Oklahoma, and Kansas, * * * and the following special forecast was made and distributed at 2:45 p. m.: "Temperature may fall to 40° at Galveston, and to 32° at points 50 to 100 miles from Galveston Friday."

The following temperatures were recorded Friday in the district for which the forecast was made: Galveston, 37.5°; Brenham, 30.0°; Columbia, 36.0°; and Missouri City, 32.0°.

The 8 a. m. weather map of Friday, December 3, 1897, indicated freezing to the coast line, and the following special forecast was included with regular a. m. local forecast: "Freezing, with minimum temperature at Galveston 30°, and 50 to 100 miles from Galveston, 24° Saturday morning."

The following temperatures were recorded Saturday in the district for which the forecast was made: Galveston, 30.0°; Brenham, 23.5°; Columbia, 27.0°; Missouri City, 26.0°.

Continued low temperature was forecast for Sunday morning, and freezing occurred again near the coast.

Prompt action was taken on the receipt of the warnings to protect the various crops in this section.

The following are from reports received at this office as to special benefits derived:

E. H. Cunningham & Co., Sugarland, Tex., say:

"Warning of December 2, received twenty-four hours before the freeze. Twelve hundred acres of sugar cane standing in the fields when warning received. Three hundred acres cut and windrowed before freeze set in, and five hundred acres additional cut on strength of warning of December 3. The service was of great value to us, enabling us to get sufficient cane in windrow before freeze came to enable us to save entire crop."

William Dunovant, Eagle Lake, Tex., says:

"Warning received about twelve hours in advance of the norther; cane farms immediately notified by telephone; every knife possible was put in the cane, and water and steam pipes drained. Value of property protected, $4,000. Cane left standing was only partially damaged, so the loss would not have been entire had none been cut; estimated value saved $1,000."

C. F. Mercer, Missouri City, Tex., says:

"Warning received about sixteen hours before freeze; perishable vegetables covered up to the value of $1,000. Special warnings are of great value and we would like them continued."

The vegetable interests in this vicinity are large and half the perishable crops were protected and saved from material injury. It is estimated that the value of that saved to truck farmers is $5,000. Exposed water pipes to the value of $10,000 (estimated) were drained and saved from injury.

A reasonable estimate of the property protected from the freeze in this vicinity as a result of the warnings of December 2 and 3 is $50,000.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During the month there were seven highs and twelve lows sufficiently well defined to be charted, and their apparent tracks will be found on Charts I and II. The principal facts regarding the place of origin or the region where first seen, and the region of disappearance or where they were last seen, their duration and velocity will be found in the accompanying table.

HIGHS.

Of the seven highs five were first noted to the north of Montana, but could not be traced to the Pacific. The other two were first noted off the middle Pacific Coast. The apparent movement of I was nearly south to Texas and then east to the Atlantic. Number III moved east and south from middle Pacific Coast and disappeared in extreme east Texas. The remaining highs moved east and southeast, and all disappeared off the Atlantic Coast. The temperature conditions accompanying these highs were remarkably moderate. Only one severe cold wave occurred during the month as high V moved southeast from the north of Montana on 15th and 16th; a. m. of 15th the temperature fell 40° in twenty-four hours at Helena and reached —4°; at Williston the fall was 38° and to —10°; p. m. of 15th the temperature fell 44° at Denver and reached 2°. Morning of 16th the cold wave extended to the Mississippi Valley; the temperature fall at Pueblo was 40°, at Sioux City and Concordia was 34°, and at Omaha, Dodge City, and Amarillo it was 32°. On morning of 17th this cold wave was much diminished, and it continued diminishing till the high disappeared off the New England Coast p. m. of 20th.

LOWS.

Of the lows, six were first noted off the north Pacific Coast, one to the north of Montana, one off the south Pacific Coast, three in the west Gulf, and one in the upper Lake Region. The apparent motion of these lows was toward Newfoundland, where eight were last noted; the others were last seen in the upper Lake Region. As low V approached the Atlantic Coast the wind reached 56 miles an hour at Block Island p. m. of the 14th. As low XII approached the upper Lakes it caused a wind of 56 miles an hour at Chicago, and as it came near the lower Lakes, morning of the 30th, the wind at Buffalo reached 56 miles an hour.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*29, a. m.	53	117	6, p. m.	33	78	3,120	7.5	416	17.3
II	4, p. m.	52	108	9, a. m.	46	57	2,730	4.5	607	25.3
III	8, p. m.	37	124	11, p. m.	32	108	1,550	3.0	517	21.5
IV	10, p. m.	38	125	16, a. m.	33	81	3,410	5.5	620	25.8
V	14, a. m.	53	118	20, p. m.	41	69	3,040	6.5	468	19.5
VI	22, a. m.	53	105	25, p. m.	37	74	1,940	3.5	554	23.1
VII	26, a. m.	52	101	30, p. m.	28	80	3,030	4.5	673	28.0
Total							18,820	35.0	3,855	
Mean of 7 tracks							2,689		551	22.9
Mean of 35 days									538	22.4
Low areas.										
I	*29, a. m.	48	128	2, p. m.	49	52	3,910	3.5	1,117	46.5
II	1, a. m.	33	116	6, a. m.	49	54	3,930	5.0	786	32.8
III	4, p. m.	49	127	7, p. m.	46	79	2,280	3.0	760	31.7
IV	7, a. m.	49	128	13, a. m.	46	59	4,030	7.0	576	24.0
V	10, p. m.	47	127	16, p. m.	48	56	4,790	6.0	798	33.2
VI	13, a. m.	48	126	16, a. m.	48	87	2,680	3.0	893	37.2
VII	16, p. m.	26	99	19, p. m.	47	55	2,840	3.0	947	39.5
VIII	19, p. m.	30	96	21, p. m.	47	55	2,200	2.0	1,100	45.8
IX	21, a. m.	48	82	23, a. m.	48	79	340	2.0	170	7.1
X	23, p. m.	54	111	25, p. m.	47	76	1,800	3.0	600	25.0
XI	25, a. m.	29	89	27, p. m.	47	58	2,100	2.5	840	35.0
XII	27, a. m.	48	129	31, a. m.	49	64	2,960	4.0	740	30.8
Total							33,860	44.0	9,327	
Mean of 12 tracks							2,822		777	32.4
Mean of 44.0 days									770	32.1

* November.

CLIMATOLOGY OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

GENERAL CHARACTERISTICS.

On the north Pacific Coast there was much rain; the valleys of the Chehalis and Skyhomish were flooded, greatly to the detriment of property interests therein; temperature was somewhat above normal; there were violent winds at times which contributed to the destruction of several vessels and the loss of half a score or more of lives.

On the middle and south Pacific coasts the reverse conditions obtained. Cold, dry winds prevailed, and the temperature over middle and southern California and Arizona fell to a lower point than usual. The prolonged cold spells of the 3d–4th, 19th, 20th, 21st, and 22d caused more or less apprehension for the safety of citrus fruits and trees; later reports, however, showed that the damage was less than anticipated.

The weather of the Rocky Mountain and Plateau Region was colder than usual; the precipitation was mostly in the form of snow and somewhat less than the normal amount.

East of the Rocky Mountains cold weather with rain and snow prevailed on the 2d, 3d, 4th, and 5th. Freezing temperatures occurred as far south as Texas, the Gulf Coast, and Louisiana.

The remarkably low temperature of forty-three degrees below zero (—43°) was recorded at Havre on the morning of the 2d. Observer C. W. Ling in charge of that station writes concerning the phenomenon as follows:

> The range of temperature, 68° on the 3d, is the greatest daily range on record at this station for eighteen years past, and the temperature, 43° below zero on the 2d, is the lowest on record for this station for first decade of December, and also the lowest that has ever occurred at this station so early in the season. The total daily wind movement was 26 miles on the 1st and 8 miles on the 2d, 8 miles being the least total daily wind movement on record for this station.

Cloudy weather with occasional rain or snow prevailed east of the Mississippi River from the 8th to the 15th. Heavy fog interfered with navigation on the Great Lakes on the 9th and on the North Atlantic on the 10th.

On the 14th a cold wave appeared north of Montana, which gradually spread eastward and southward with rain, changing to sleet and snow on its front. The cold wave was preceded by a rain and snow storm throughout Kansas, Nebraska, and Missouri on the 13th and 14th, which continued for about eighteen hours. By the morning of the 16th the front of the cold wave had reached northern Texas, Oklahoma, Arkansas, Missouri, and Illinois; it was accompanied in many cases by a thunderstorm. The temperature fall was quite sharp, being as much as 40° in five hours, in some instances. Several deaths from cold were reported. Much damage, especially to electric wires, trees, and shrubbery, was done by the rain and sleet storm throughout northern Texas, Arkansas, western Tennessee, and Missouri on the 19th and 20th. It had been raining or snowing throughout this region since the 17th and at many places the rain froze as it fell, forming a thick coating of ice over exposed objects. The ice layer so formed was greatly augmented by the heavy fall of sleet that occurred on the night of the 19th. Wires broke under the load, trees were denuded of their limbs, and, according to press dispatches, at least three lives were lost by falling limbs.

Alternating clear and cloudy weather, with rain or snow at times, prevailed from the 21st until the end of the month. On the 31st a severe rain and snow storm passed over the upper Ohio Valley and the Middle States, the greatest financial loss being sustained in Pittsburg, where at least a foot of snow fell, completely wrecking the various systems of electric wires and temporarily blocking traffic on streets and street car lines.

The greatest fogginess during the month occurred from the 9th to the 12th in the Lake Region and on the north Atlantic Coast.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

In December atmospheric pressure is generally greatest over the middle Plateau Region, where it averages about 30.25 inches. There is also a smaller area of relatively high pressure over western North and South Carolina, northern Georgia, and eastern Tennessee. Pressure is generally least in the St. Lawrence Valley and the north Pacific Coast. From both of these regions pressure decreases toward the permanent areas of low pressure in the north Atlantic Ocean and Bering Sea, respectively. In the United States there is generally an increase of pressure from November to December.

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The distribution of mean pressure for the current month reduced to sea level does not differ in a marked degree from the normal.

Pressure was below normal over the middle plateau in November, 1897. The single area of high pressure inclosed by isobars varying from 30.15 to 30.30 inches, that generally appears in that region, was broken into two separate areas of 30.15 inches the greater of which covered Assiniboia and the Dakotas (see Chart IV, November REVIEW). The greatest increase in pressure during the current month was in the region above named, where, during last month, pressure was relatively low. Aside from the fact that pressure on the Pacific Coast, the Rocky Mountain, and Plateau Regions was much greater than usual there were no special features that call for remark. The pressure distribution on the Pacific Coast and Plateau Region was not favorable to precipitation over middle and southern California.

The numerical values of Table I should be consulted for additional details.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The month was generally colder than usual. Unseasonable temperatures, with heavy frost in exposed places, occurred in southern California and Arizona on the 3d, and again on the 19th, 20th, 21st, and 22d, the cold of the last-named period being the most severe of the month. The temperature fell to 30° at Los Angeles on the morning of the 21st, a point as low as ever before recorded during December. The cold wave of the 3d–5th, east of the Rocky Mountains, overspread the plains region and Texas, moving eastward from the latter point into Louisiana by the morning of the 5th. Snow and sleet prevailed over northern Texas and snow flurries over the interior of Louisiana. The temperature in these regions fell to the lowest point reached during the month. The first killing frost and ice of the season at New

Orleans were observed on the morning of the 5th. On the 14th an area of high pressure appeared north of Montana. It gradually spread southward and eastward reaching the middle Mississippi Valley by the morning of the 16th, the Texas Coast by the morning of the 17th, and the north Atlantic Coast during the 18th. The temperature gradients in front of the advancing cold were rather steep and the advent of colder weather was marked by sharp squall winds with rain, sleet, or snow. While there were no severe cold waves during the month, there were frequent alternations from warm to cold, or from rain to snow and sleet.

The mean temperatures and the departures from the normal, as determined from records of the maximum and minimum thermometers, are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II. The mean temperatures given in Table III for Canadian stations are the simple means of 8 a. m. and 8 p. m. simultaneous observations.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean* temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *years of highest and lowest mean temperatures* for December are shown in Table I of the REVIEW for December, 1894. The mean temperature for the current month was neither the highest nor the lowest on record at any regular station of the Weather Bureau at which observations have been made for a period of twenty years or more.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 89, Los Angeles (29th); 83, Key West (3d), Jupiter (22d); 82, San Luis Obispo (30th); 80, Jacksonville (4th), San Diego (13th). The lowest maxima were: 40, Duluth (9th); 41, Idaho Falls (8th); 44, Moorhead (29th); 45, Sault Ste. Marie (9th), Moorhead (29th); 46, St. Paul, Minneapolis, La Crosse, Greenbay, and Dubuque (9th). The highest minima were: 51, Key West (28th); 49, Jupiter (29th); 40, Tampa (9th); 39, Charleston (26th), San Francisco (22d); 38, Port Eads (5th). The lowest minima were: —43, Havre (2d); —31, Miles City (3d); —26, Williston (2d); —21, Lander (16th); —20, Huron (4th).

In Canada.—Prof. R. F. Stupart reports:

Highest maxima: Kingston, 55; Port Dover, 58; Paris, 57; Niagara, 61; Yarmouth, 57.

Lowest maxima: Prince Albert, Qu'Appelle, Port Arthur, Father Point, 38; White River, 37; Winnipeg, 33; Minnedosa, 34.

Highest minima: Esquimalt, 29; Agassiz, 15; Halifax, 7; Yarmouth, 10; Sydney, 4.

Lowest minima: Edmonton, —42; Battleford, Prince Albert, —34; White River, —43.

The *years of highest maximum and lowest minimum temperatures* for December are given in the last four columns of Table I of the REVIEW for December, 1896. During the current month the maximum temperatures were equal to or above the highest on record at: Eastport*, 54; Vineyard Haven, 62; Pensacola, 76; Port Eads, 77; Los Angeles, 89. The minimum temperatures were equal to or below the lowest on record at: Amarillo, —1; Fresno, 23; Los Angeles, 30.

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Havre, 68; Huron, 58; Pierre, 55; Pueblo, 51; San Luis Obispo, 49; Lander, 47; Cheyenne, 45. The smallest values were: Fort Canby, 13; Tatoosh Island, Pysht, 14; Seattle and Tacoma, 15; Astoria, 16; San Francisco and Key West, 17.

Among the *extreme monthly ranges* the largest were: Havre, 94; Miles City, 82; Rapid City, 77; Williston, Bismarck, Pierre, 75. The smallest values were: Tatoosh Island, 16; Fort Canby, 19; Port Angeles, 22; Astoria, 23; Pysht, San Francisco, 24; Seattle, 25.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: North Pacific, 1.1; South Atlantic and Florida Peninsula, 1.0 each. The greatest negative departures were: Upper Mississippi, 5.0; Missouri Valley, 4.8; middle Slope, 4.4; middle plateau, 4.2.

In Canada.—Professor Stupart says:

There was nothing especially remarkable about the distribution of mean temperature. Throughout British Columbia, the Northwest Territories, Manitoba, the Lake Superior district, northern Ontario, and northern Quebec it was a little below average, and over southern Ontario, southern Quebec, and in the Maritime Provinces it was a little above. The greatest departures reported were: 4° below average at White River, Ont., and 4° above at Chatham, N. B.

Accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column, for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
	°	°		°	°
New England	+ 5.5	+ 0.5	Florida Peninsula	— 0.4	0.0
Middle Atlantic	+ 4.0	+ 0.3	Northern Slope	— 0.1	0.0
South Atlantic	+ 5.5	+ 0.5	Southern Plateau	— 7.5	— 0.6
East Gulf	+ 8.4	+ 0.7	Middle Plateau	— 8.8	— 0.7
West Gulf	+11.0	+ 0.9	Middle Pacific	— 5.6	— 0.5
Ohio Valley and Tenn.	+ 8.6	+ 0.7	South Pacific	— 9.0	— 0.8
Lower Lake	+ 7.5	+ 0.6			
Upper Lake	+15.9	+ 1.3			
North Dakota	+ 2.8	+ 0.2			
Upper Mississippi Valley	+ 9.7	+ 0.8			
Missouri Valley	+ 8.9	+ 0.7			
Middle Slope	+ 8.4	+ 0.7			
Northern Plateau	+ 7.8	+ 0.6			
North Pacific	+ 0.1	0.0			
Southern Slope	0.0	0.0			

FROST.

At the end of the month freezing temperatures had occurred in all parts of the country, except on the immediate Pacific Coast, the delta of the Mississippi, and the Florida Peninsula. In the last-named, light to heavy and killing frosts occurred over the northern half of the peninsula in exposed places. The isotherms of 32° and 40°, on the snowfall Chart VI, show the southerly limits of the regions that have suffered frost or freezing weather.

PRECIPITATION.

[In inches and hundredths.]

On the whole, December, 1897, was not far from a normal month as regards precipitation. There was more than the

* Observations cover a period of twenty-five years, or more.

average on the north Pacific Coast and in the lower Mississippi Valley, but there was less than the average on the middle and south Pacific Coast. The deficiency in the Gulf and South Atlantic States, referred to in previous REVIEWS, still exists.

Considered by districts the total precipitation, i. e., rainfall and melted snow, of the current month was normal in one, above in ten, and below in ten. The amounts above or below normal in the various districts were not large, except on the Pacific Coast, where an excess of 3.70 inches, and deficits of 3.00 and 2.20 inches, respectively, were noted. Elsewhere the excess or deficiency per district was not greatly over half an inch, as will be seen by an examination of Table I.

In Canada.—Prof. R. F. Stupart says:

In the southern part of Vancouver Island the precipitation was above average, but on the mainland of British Columbia, it appears to have been, on the whole, below rather than above average amount. In the Northwest Territories and Manitoba, where it was chiefly snow, it was above average almost everywhere, and especially so at Prince Albert and Winnipeg. Along the north shore of Lake Superior, in the lower St. Lawrence Valley, the Gulf, and in the Maritime Provinces, it was below the average, and in the eastern and southern portions of these latter provinces to a considerable extent, Yarmouth being 3.2 inches below, Halifax 1.9 below, and Sydney 2.2 inches below. Over the greater part of Ontario and over the extreme western part of Quebec it was above the average, Parry Sound being as much as 2.1 inches above and Montreal 2.2 above. In southern Ontario, generally, it was nearly average, but locally, in the southwestern portion, there appears to have been a small deficiency.

The *average departure* for each district is given in Table I. By dividing each current precipitation by its respective normal the following corresponding percentages are obtained (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: New England, 119; middle Atlantic, 119; south Atlantic, 103; east Gulf, 114; west Gulf, 124; Ohio Valley and Tennessee, 117; Missouri Valley, 140; northern Slope, 147; northern Plateau, 110; north Pacific, 140.

Normal: Florida Peninsula, 100.

Below the normal: Lower Lake, 86; upper Lake, 91; North Dakota, 38; upper Mississippi, 95; middle Slope, 67; southern Slope, 49; southern Plateau, 32; middle Plateau, 82; middle Pacific, 46; south Pacific, 11.

The *years of greatest and least precipitation* for December are given in the REVIEW for December, 1890. The precipitation for the current month was the greatest on record at: Narragansett Pier, 6.70; Cheyenne,* 1.27; Port Angeles, 9.85. It was the least on record at: Minneapolis, 0.13; Oklahoma, 0.70; Fresno, 0.48; Los Angeles, 0.05.

The *total accumulated monthly departures* from January 1 to the end of the current month are given in the second column of the following table; the third column gives the current accumulated precipitation expressed as a percentage of its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	*Per ct.*		*Inches.*	*Per ct.*
New England	+ 0.90	102	Middle Atlantic	— 3.50	93
Florida Peninsula	+11.30	122	South Atlantic	— 4.70	91
Middle Slope	+ 0.30	101	East Gulf	— 5.30	90
Southern Plateau	+ 3.20	138	West Gulf	—10.50	76
Northern Plateau	+ 2.50	115	Ohio Valley and Tenn.	— 1.30	97
North Pacific	+ 3.00	105	Lower Lake	— 3.90	89
Middle Plateau	0.00	100	Upper Lake	— 3.10	91
			North Dakota	— 1.90	90
			Upper Mississippi Valley	— 2.10	94
			Missouri Valley	— 3.30	89
			Northern Slope	— 0.30	98
			Southern Slope	— 0.60	97
			Middle Pacific	— 5.80	80
			South Pacific	— 1.60	87

* Observations cover a period of over twenty-five years.

SNOWFALL.

The *total monthly snowfall* at each station, if any occurs, is given in Tables I and II. The geographical distribution of snowfall is shown on Chart VI. Practically no snow fell from Chesapeake Bay westward to the foothills of the Appalachians and southward to the Gulf. No reports of snow were received from a narrow fringe of country on the Pacific Coast extending from Tatoosh Island on the north to San Diego on the south, although it is quite certain that snow fell on the higher peaks and ridges of that region.

Ordinarily the southern limit of snowfall in December is found farther to the southward than is the case for the current month. The total depth of snowfall for the month is graphically shown on Chart VI by lines of equal snowfall. In drawing these lines only average depths at several stations in the same locality are considered.

SNOW ON THE GROUND AT THE END OF THE MONTH.

The depth of snow on the ground at the close of the month is shown on Chart VII.

It will be seen that the ground was covered with snow in the Rocky Mountain and Plateau regions, although the depth was not so great as on November 30. There was no snow on the ground over a narrow strip extending from Kansas northward to the British Possessions.

A heavy snowstorm prevailed throughout the upper Ohio Valley and the Middle States on the 31st and this region, as will be seen by reference to the chart, shows a greater depth of snow than is to be found elsewhere, except in isolated localities, as the upper peninsula of Michigan and at a few stations in mountainous regions.

In Canada.—Prof. R. F. Stupart says:

At the close of the month the only portions of the Dominion which had not a covering of snow were southern British Columbia, southern Alberta and southwestern Assiniboia, the greater part of Nova Scotia and New Brunswick near the Bay of Fundy. The snowfall in the mountains is reported as less than average, although at Glacier nearly 9 feet are reported to have fallen. In northern Cariboo it is 20 inches on the level, and at Kamloops 6 inches. At Prince Albert it is 21 inches, and at Winnipeg 12 inches.

ICE IN RIVERS AND HARBORS AT THE CLOSE OF THE MONTH.

The "Snow and Ice chart" of January 3, 1898, contains the following:

In the Missouri River ice ranges from 10 inches at Omaha to 20 inches at Bismarck and Williston, N. Dak.; in the Mississippi, from 9 inches at Hannibal to 15.5 at St. Paul, being generally from 1 to 3 inches more than reported on December 27. Considerably more ice is also reported at stations along the Great Lakes and New England. In the Mohawk River it averages 8 inches, and in the Hudson ranges from 8 inches at Glens Falls to floating ice at Poughkeepsie, the ice in both the Mohawk and Hudson being very lumpy, necessitating much planing before harvesting. In the rivers of New England the ice generally ranges from 7 to 9 inches in thickness. As compared with the corresponding date of last year there is decidedly more ice over the western sections of the country, but in the rivers of Maine there is somewhat less.

In Canada.—Prof. R. F. Stupart reports the following figures:

Medicine Hat and Swift Current, 16 inches; Minnedosa, 18 inches; Winnipeg, 10 inches; White River, 22 inches; Orillia, 8 inches; Arden, 8 inches; Georgetown, 6 inches; Midland, 7 inches; Parry Sound, 4 inches; Port Stanley, 6 inches; Rockliffe, 6 inches; Chatham, N. B., 9 inches; Yarmouth, 2 inches; Grand Manan, 5 inches; Charlottetown, 6 inches.

HAIL.

The following are the dates on which hail fell in the respective States:

California, 1, 14. Missouri, 17. North Carolina, 14. West Virginia, 31. Oregon, 6, 7, 8, 11.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 25. Arizona, 1, 2, 8, 15, 18, 19, 20, 23. Arkansas, 2, 14, 16, 17, 18, 19, 20, 21, 25, 31. California, 4, 18. Connecticut, 17, 26. Delaware, 20, 26, Georgia, 5, 14, 25, 26. Idaho, 15. Illinois, 2, 3, 4, 5, 6, 10, 13, 14, 16, 17, 19, 20, 25, 28, 30, 31. Indiana, 1, 2, 3, 4, 5, 13, 17, 19, 20. Iowa, 3, 4, 6, 7. Kansas, 2, 3, 4, 6, 9, 12, 13, 16, 17, 18, 19, 20, 27. Kentucky, 2, 3, 4, 14, 16, 17, 18, 19, 20, 21, 24, 30, 31. Louisiana, 3, 4, 18, 19, 23, 24. Maine, 14, 21. Maryland, 3, 4, 20, 22, 26. Massachusetts, 17, 31. Michigan, 4, 5, 6, 13, 14, 20, 29, 30. Minnesota, 6, 7, 11, 15. Mississippi, 4, 17, 18, 19, 21, 25, 26, 27. Missouri, 2, 3, 4, 5, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 25, 29, 30, 31. Montana, 14, 15, 23, 25. Nebraska, 20, 27, 30. Nevada, 2, 6, 7, 8, 10, 11, 18, 19. New Hampshire, 12, 14, 21. New Jersey, 3, 4, 8, 9, 15, 20, 21, 22, 23, 26, 30, 31. New York, 4, 5, 6, 7, 13, 14, 17, 20, 26, 30. North Carolina, 20, 21, 25, 26, 29, 30, 31. North Dakota, 4, 5, 7, 11, 12, 29, 30. Ohio, 2, 3, 4, 5, 7, 17, 20, 21, 22, 25, 29, 30, 31. Oklahoma, 2. Oregon, 1, 4, 5, 9, 17, 24. Pennsylvania, 3, 4, 5, 17, 19, 20, 21, 26, 31. South Carolina, 25. South Dakota, 4, 5, 10, 12, 13. Tennessee, 2, 4, 5, 14, 15, 17, 18, 19, 20, 21, 25, 26, 31. Texas, 2, 3, 4, 16, 17, 18, 19, 20, 21. Utah, 8, 12, 14. Vermont, 14, 15, 17, 18. Virginia, 2, 19, 20, 25, 26, 27, 28, 29. Washington, 4, 15, 16, 25, 26. West Virginia, 19, 20, 29, 31. Wisconsin, 3, 4, 5, 6, 12, 13, 28.

WIND.

The *prevailing winds* for December, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

Maximum wind velocities are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Amarillo, Tex.	12	56	n.	Fort Canby, Wash.	31	50	e.
Do.	13	54	nw.	Carson City, Nev	6	57	sw.
Do.	15	54	w.	Do.	7	56	w.
Block Island, R. I.	14	54	e.	Cheyenne Wyo	7	50	w.
Buffalo, N. Y	5	60	w.	Chicago, Ill	16	56	sw.
Do.	16	51	w.	Do.	29	56	sw.
Do.	29	53	w.	Cleveland, Ohio	23	56	nw.
Do.	30	53	w.	Do.	24	50	nw.
Fort Canby, Wash.	4	78	se.	Denver, Colo	7	53	w.
Do.	6	86	s.	Do.	30	52	w.
Do.	7	84	s.	Havre, Mont.	26	60	nw.
Do.	8	63	s.	Sioux City, Iowa.	15	51	nw.
Do.	10	54	se.	Do.	16	53	nw.
Do.	13	75	se.	Tatoosh Island, Wash.	6	60	e.
Do.	23	60	s.	Do.	13	54	w.
Do.	24	59	s.	Do.	27	53	s.
Do.	25	60	se.	Do.	30	55	e.
Do.	26	72	s.	Do.	31	63	e.
Do.	27	72	s.	Woods Hole, Mass.	18	54	nw.
Do.	28	60	s.	Do.	24	50	w.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 9th, 27; 10th, 24; 13th, 30.

Reports were most numerous from: Louisiana, 26; Mississippi and Missouri, 15; Oregon, 24.

Thunderstorm days were most numerous in: Alabama, Missouri, and Oregon, 5; Louisiana, 12; Mississippi, 7.

In Canada.—Professor Stupart reports thunderstorms as follows: at Bermuda on the 15th.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 4th to the 12th, inclusive. On the remaining twenty-two days of this month 128 reports were received, or an average of about 6 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 20th, 40; 21st, 27.

Reports were most numerous from: Illinois, 11; Minnesota and Montana, 20; North and South Dakota, respectively, 10.

The number of reports was a large percentage of the number of observers in: Minnesota, 29: Montana, 54; North Dakota, 20; and South Dakota, 23.

In Canada.—Professor Stupart reports auroras on the following dates: Father Point, 20, 21, 28, 29; Winnipeg, 20, 31; Minnedosa, 1, 15, 17, 18, 20, 21, 22, 29; Qu'Appelle, 30, 31; Medicine Hat, 10, 20, 22, 23, 26, 28, 30; Swift Current, 22; Prince Albert, 2; Edmonton, 20; Battleford, 2, 4, 15, 29, 30, 31.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 47 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X for the stations at which instrumental self-registers are maintained.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentages of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely.

For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for December, 1897, is 5 per cent for photographic and 4 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

Difference between instrumental and personal observations of sunshine.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
	° ′		H'rs.	%	%	%	%	%
Key West, Fla	24 34	T.	339.1	55	.....	.....	70	+15
Tampa, Fla	27 57	T.	322.9	57	.....	.....	58	+ 1
Galveston, Tex	29 18	P.	330.2	42	44	+ 2	.....	.....
New Orleans, La	29 58	T.	317.8	55	.....	.....	55	0
Jacksonville, Fla	30 20	T.	317.8	50	.....	.....	60	+10
Savannah, Ga	32 05	P.	313.0	44	49	+ 5	.....	.....
Vicksburg, Miss	32 22	T.	313.0	37	.....	.....	39	+ 2
San Diego, Cal	32 43	P.	310.7	79	88	+ 9	.....	.....
Charleston, S. C.	32 47	T.	310.7	43	.....	.....	41	− 2
Phœnix, Ariz	33 28	P.	310.7	74	87	+13	.....	.....
Atlanta, Ga	33 45	T.	307.7	28	.....	.....	33	+ 5
Los Angeles, Cal	34 03	P.	307.7	79	85	+ 6	.....	.....
Wilmington, N. C.	34 14	T.	307.7	45	.....	.....	48	+ 3
Little Rock, Ark	34 45	T.	305.2	29	.....	.....	41	+12
Chattanooga, Tenn	35 04	T.	305.2	26	.....	.....	25	− 1
Oklahoma, Okla	35 26	T.	305.2	54	.....	.....	58	+ 4
Santa Fe, N. Mex	35 41	P.	302.5	72	81	+ 9	.....	.....
Raleigh, N. C.	35 45	T.	302.5	40	.....	.....	41	+ 1
Knoxville, Tenn	35 56	T.	302.5	26	.....	.....	31	+ 5
Nashville, Tenn	36 10	T.	302.5	21	.....	.....	27	+ 6
Fresno, Cal	36 43	T.	299.4	67	.....	.....	72	+ 5
Dodge City, Kans	37 45	P.	296.7	64	71	+ 7	.....	.....
San Francisco, Cal	37 48	T.	296.7	55	.....	.....	71	+16
Louisville, Ky	38 15	T.	296.7	17	.....	.....	24	+ 7

Difference between instrumental and personal observations—Cont'd.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
	° ′		H'rs.	%	%	%	%	%
St. Louis, Mo	38 38	T.	293.7	19	.....	.....	29	+10
Washington, D. C	38 54	P.	293.7	51	50	− 1	.....	.....
Kansas City, Mo	39 05	P.	293.7	30	36	+ 6	.....	.....
Cincinnati, Ohio	39 06	T.	293.7	29	.....	.....	35	+ 6
Parkersburg, W. Va	39 16	T.	293.7	17	.....	.....	19	+ 2
Baltimore, Md	39 18	T.	293.7	42	.....	.....	54	+12
Atlantic City, N. J	39 22	P.	293.7	39	49	+10	.....	.....
Denver, Colo	39 45	P.	291.7	55	68	+13	.....	.....
Indianapolis, Ind	39 46	T.	291.7	19	.....	.....	22	+ 3
Philadelphia, Pa	39 57	T.	291.7	33	.....	.....	49	+16
Columbus, Ohio	39 58	T.	291.7	31	.....	.....	15	−16
Harrisburg, Pa	40 16	T.	291.7	27	.....	.....	41	+14
Pittsburg, Pa	40 32	T.	287.8	16	.....	.....	16	0
New York, N. Y	40 43	T.	287.8	38	.....	.....	46	+ 8
Salt Lake City, Utah	40 46	P.	287.8	50	48	− 2	.....	.....
Eureka, Cal	40 48	P.	287.8	49	53	+ 4	.....	.....
Cheyenne, Wyo	41 08	P.	287.8	51	59	+ 8	.....	.....
Omaha, Nebr	41 16	P.	287.8	37	38	+ 1	.....	.....
Cleveland, Ohio	41 30	T.	284.7	9	.....	.....	9	0
Des Moines, Iowa	41 35	T.	284.7	48	.....	.....	51	+ 3
Chicago, Ill	41 53	T.	284.7	31	.....	.....	30	− 1
Erie, Pa	42 07	T.	284.7	18	.....	.....	11	− 7
Binghamton, N. Y	42 08	T.	284.7	23	.....	.....	27	+ 4
Detroit, Mich	42 20	T.	284.7	29	.....	.....	28	− 1
Boston, Mass	42 21	T.	284.7	36	.....	.....	46	+10
Dubuque, Iowa	42 30	T.	284.7	41	.....	.....	41	0
Albany, N. Y	42 39	T.	281.0	23	.....	.....	30	+ 7
Buffalo, N. Y	42 53	T.	281.0	12	.....	.....	22	+10
Yankton, S. Dak	42 54	T.	281.0	41	.....	.....	47	+ 6
Rochester, N. Y	43 08	T.	281.0	12	.....	.....	14	+ 2
Idaho Falls, Idaho*	43 29	T.	281.0	34	.....	.....	.....	.....
Portland, Me	43 39	T.	277.7	35	.....	.....	37	+ 2
Northfield, Vt	44 10	P.	277.7	28	29	+ 1	.....	.....
Huron, S. Dak	44 21	T.	277.7	37	.....	.....	42	+ 5
Eastport, Me	44 54	P.	274.3	32	39	+ 7	.....	.....
St. Paul, Minn	44 58	P.	274.3	44	42	− 2	.....	.....
Minneapolis, Minn	44 59	T.	274.3	.....	.....	.....	35	.....
Portland, Oreg	45 32	T.	269.6	28	.....	.....	28	0
	45 32	P.	269.6	28	25	− 3	.....	.....
Helena, Mont	46 34	P.	265.6	39	38	− 1	.....	.....
Bismarck, N. Dak	46 47	P.	265.6	45	48	+ 3	.....	.....
Tacoma, Wash	47 16	T.	265.6	13	.....	.....	13	0
Seattle, Wash	47 38	T.	262.1	19	.....	.....	6	−13
Spokane, Wash	47 40	T.	262.1	17	.....	.....	14	− 3

*Instrument out of order.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 47.8°, or 0.8° above normal; the highest was 82°, at Eufaula on the 5th, and the lowest, 19°, at Hamilton on the 31st. The average precipitation was 5.82, or 2.20 above normal; the greatest monthly amount, 12.13, occurred at Jasper, and the least, 1.05, at Clanton.—*F. P. Chaffee.*

Arizona.—The mean temperature was 43.5°, or 9.5° below normal; the highest was 89°, at Maricopa, and the lowest, 12° below zero at Williams. The average precipitation was 0.42, or 0.06 above normal; the greatest monthly amount, 1.50, occurred at Flagstaff, while none fell at Calabasas, Casa Grande, Fort Mohave, and Gila Bend.—*W. T. Blythe.*

Arkansas.—The mean temperature was 40.4°, or 3.1° below normal; the highest was 81°, at Bee Branch on the 9th, and the lowest, 10°, at Dallas, Fayetteville, and Winslow on the 4th. The average precipitation was 6.00, or 1.35 above normal; the greatest monthly amount, 9.11, occurred at Blanchard, and the least, 2.74, at Dardanelle.—*F. H. Clarke.*

California.—The mean temperature was 44.4°, or 8.5° below normal; the highest was 94°, at Downey on the 28th, and the lowest, 20° below zero, at Bodie on the 20th. The average precipitation was 1.75, or 2.67 below normal; the greatest monthly amount, 10.66, occurred at Crescent City, while none fell at several stations.—*H. W. Hammon.*

Colorado.—The mean temperature was 23.1°, or 3.2° below normal; the highest was 74°, at Rockyford on the 8th, and the lowest, 33° below zero, at Steamboat Springs on the 20th. The average precipitation was 0.90, or 0.18 below normal; the greatest monthly amount, 5.75, occurred at Ruby, and the least, 0.05, at Vilas.—*F. H. Brandenburg.*

Florida.—The mean temperature was 60.4°, or slightly above normal; the highest was 91°, at Lemon City on the 9th, and the lowest, 28°, at De Funiak Springs on the 5th, at Perry on the 27th and 28th, and at Wausau on the 6th. The average precipitation was 2.84, or about 0.50 above normal; the greatest monthly amount, 6.50, occurred at Carrabelle, and the least, 1.00, at Lemon City.—*A. J. Mitchell.*

Georgia.—The mean temperature was 48.4°, or 1.1° above normal; the highest was 84°, at Bragg on the 4th and 11th, and the lowest, 18°, at Toccoa on the 24th. The average precipitation was 3.66, or 0.58 below normal; the greatest monthly amount, 7.97, occurred at Diamond, and the least, 1.51, at Talbotton.—*J. B. Marbury.*

Idaho.—The mean temperature was 24.5°; the highest was 57°, at Idaho City on the 29th, and the lowest, 27° below zero, at Gray on the 18th. The average precipitation was 2.08; the greatest monthly amount, 6.49, occurred at St. Maries, and the least, 0.58, at Rexburg.—*D. P. McCallum.*

Illinois.—The mean temperature was 27.3°, or 2.4° below normal; the highest was 72°, at Albion on the 10th, and the lowest, 18° below zero, at Scales Mound on the 18th. The average precipitation was 2.38, or 0.07 below normal; the greatest monthly amount, 5.15, occurred at Cobden, and the least, 0.84, at Sycamore.—*C. E. Linney.*

Indiana.—The mean temperature was 31.6°, or 1.6° below normal; the highest was 70°, at Boonville on the 9th, and at Vevay and Washington on the 10th, and the lowest, 9° below zero, at Topeka on the 24th. The average precipitation was 2.65, or 0.14 below normal; the greatest

monthly amount, 4.37, occurred at Rockville, and the least, 0.61, at Valparaiso.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 18.0°, or 5.0° below normal; the highest was 60°, at Denison and Mount Pleasant on the 9th, and the lowest, 25° below zero, at Atlantic on the 18th. The average precipitation was 1.65, or 0.34 above normal; the greatest monthly amount, 3.22, occurred at Ovid, and the least, 0.61, at Burlington.—*G. M. Chappel.*

Kansas.—The mean temperature was 29.0°, or 5.6° below normal; the highest was 79°, at Coolidge on the 8th, and the lowest, 16° below zero, at Phillipsburg on the 16th. The average precipitation was 0.78; the greatest monthly amount, 3.06, occurred at Fort Scott, and the least, trace, at Meade.—*T. B. Jennings.*

Kentucky.—The mean temperature was 38.0°, or 1.2° below normal; the highest was 72°, at Henderson on the 9th, and the lowest, 3° at Mount Sterling on the 24th. The average precipitation was 3.75, or 0.25 above normal; the greatest monthly amount, 5.60, occurred at Williamsburg, and the least, 2.47, at Scott.—*Frank Burke.*

Louisiana.—The mean temperature was 52.3°, or 1.5° below normal; the highest was 89°, at Southern University Farm (near New Orleans) on the 30th, and the lowest, 17°, at Plaindealing on the 4th. The average precipitation was 7.29, or 3.39 above normal; the greatest monthly amount, 14.60, occurred at Robeline, and the least, 3.13, at Rayne.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 36.9°, or 1.3° above normal; the highest was 74°, at Pocomoke City on the 11th, and the lowest, 4° below zero, at Deerpark on the 25th. The average precipitation was 3.57, or 0.61 above normal; the greatest monthly amount, 6.38, occurred at Sunnyside, and the least, 1.96, at Westernport.—*F. J. Walz.*

Michigan.—The mean temperature was 24.3°, or 4.0° below normal; the highest was 65°, at Coldwater on the 9th and 10th, and the lowest, 22° below zero, at Grayling on the 24th. The average precipitation was 2.41, or about normal; the greatest monthly amount, 5.80, occurred at Berrien, and the least, 0.76, at Humboldt.—*C. F. Schneider.*

Minnesota.—The mean temperature was 12.3°, or 5.0° below normal; the highest was 58° at Lesueur on the 29th, and the lowest, 36° below zero, at Tower on the 26th. The average precipitation was 0.38, or 0.41 below normal; the greatest monthly amount, 1.25, occurred at Albert Lea, and the least, trace, at Detroit City, New London, and Lakeside.—*T. S. Outram.*

Mississippi.—The mean temperature was 47.4°, or about normal; the highest was 85°, at Lake on the 9th, and the lowest, 21°, at French Camp, Louisville, and Pontotoc on the 5th. The average precipitation was 8.54, or 3.41 above normal; the greatest monthly amount, 14.78, occurred at Edwards, and the least, 2.71, at Poplarville.—*R. J. Hyatt.*

Missouri.—The mean temperature was 29.3°, or 4.6° below normal; the highest was 74°, at Mount Vernon on the 9th, and the lowest, 14° below zero, at Sublett on the 18th. The average precipitation was 2.81, or 0.81 above normal; the greatest monthly amount, 6.61, occurred at Birchtree, and the least, 0.61, at Darksville.—*A. E. Hackett.*

Montana.—The mean temperature was 22.7°, or 2.0° below normal; the highest was 61°, at Billings on the 27th, and the lowest, 45° below zero, at Chinook on the 2d. The average precipitation was 0.80; the greatest monthly amount, 3.80, occurred at Castle, and the least, 0.03, at Fort Keogh.—*J. Warren Smith.*

Nebraska.—The mean temperature was 22.9°, or 2.9° below normal; the highest was 68°, at Kearney on the 11th, and the lowest, 26° below zero, at Ashland on the 18th. The average precipitation was 1.31, or 0.61 above normal; the greatest monthly amount, 3.10, occurred at Wakefield, and the least, 0.10, at Willard.—*G. A. Loveland.*

Nevada.—The mean temperature was 29.1°, or 1.4° below normal; the highest was 69°, at Candelaria on the 30th, and the lowest, 14° below zero, at McGill on the 20th. The average precipitation was 1.06, or 0.31 below normal; the greatest monthly amount, 4.21, occurred at Lewers Ranch, while none fell at Hot Springs and Darrough Ranch.—*R. F. Young.*

New England.—The mean temperature was 28.4°, or 1.5° above normal; the highest was 64°, at Boston, Mass., on the 10th, and the lowest, 18° below zero, at Enosburg Falls, Vt., on the 25th. The average precipitation was 4.78, or 1.28 above normal; the greatest monthly amount, 7.36, occurred at Vernon, Vt., and the least, 2.10, at Burlington, Vt.—*J. W. Smith.*

New Jersey.—The mean temperature was 35.1°, or about normal; the highest was 69°, at Toms River on the 11th, and the lowest, 3° below zero, at Rivervale and Somerville on the 29th. The average precipitation was 4.90, or 1.79 above normal; the greatest monthly amount, 6.44, occurred at Englewood, and the least, 3.07, at Hightown.—*E. W. McGann.*

New Mexico.—The mean temperature was 33.4°, or 2.6° below normal; the highest was 78°, at Eddy on the 30th, and the lowest, 17° below zero, at Buckmans on the 17th. The average precipitation was below normal; the greatest monthly amount, 2.55, occurred at Fort Wingate, while none fell at Olio and Socorro.—*H. B. Hersey.*

New York.—The mean temperature was 29.0°, or 0.9° above normal; the highest was 65°, at Lyons on the 9th, and the lowest, 21° below zero, at Canton on the 25th. The average precipitation was 3.78, or 0.91 above normal; the greatest monthly amount, 6.71, occurred at Port Jervis, and the least, 1.56, at Penn Yan.—*R. M. Hardinge.*

North Carolina.—The mean temperature was 43.9°, or 1.1° above normal; the highest was 76°, at Newbern on the 10th, and the lowest, 10°, at Linville on the 24th and at Oakridge on the 25th. The average precipitation was 3.67, or about normal; the greatest monthly amount, 7.81, occurred at Hatteras, and the least, 1.68, at Southern Pines.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 10.8°, or 2.3° below normal; the highest was 69°, at Berthold Agency on the 11th, and the lowest, 35° below zero, at Berthold Agency on the 3d. The average precipitation was 0.22, or 0.29 below normal; the greatest monthly amount, 0.67, occurred at Hamilton, and the least, trace, at several stations.—*B. H. Bronson.*

Ohio.—The mean temperature was 32.8°, or about normal; the highest was 71°, at Logan on the 9th, and the lowest, 7° below zero, at Sylvania on the 23d, and at Leipsic and Wauseon on the 24th. The average precipitation was 2.39, or 0.14 below normal; the greatest monthly amount, 4.96, occurred at McConnelsville, and the least, 0.90, at Bellefontaine.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 36.6°; the highest was 81°, at Edmond on the 9th, and the lowest, zero, at Fort Reno on the 4th. The average precipitation was 1.01; the greatest monthly amount, 5.22, occurred at South McAlester, and the least, 0.03, at Purcell.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 38.9°, or slightly above normal; the highest was 81°, at Dayville on the 28th, and the lowest, 4° below zero, at Burns on the 31st. The average precipitation was 8.02, or 1.74 above normal; the greatest monthly amount, 42.21, occurred at Glenora, and the least, 0.95, at Burns.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 33.0°, or 1.1° above normal; the highest was 73°, at Cannonsburg on the 9th, and the lowest, 6° below zero, at Franklin on the 23d and at Saegerstown on the 29th. The average precipitation was 3.95, or 0.86 above normal; the greatest monthly amount, 6.25, occurred at Hamburg, and the least, 1.28, at Reedsville.—*T. F. Townsend.*

South Carolina.—The mean temperature was 47.6°, or about normal; the highest was 82°, at Trial on the 11th, and the lowest, 21°, at Holland on the 1st. The average precipitation was 2.40, or 1.15 below normal; the greatest monthly amount, 4.11, occurred at Walhalla, and the least, 1.10, at Georgetown.—*J. W. Bauer.*

South Dakota.—The mean temperature was 18.2°, or 4.8° below normal; the highest was 69°, at Ashcroft on the 9th, and the lowest, 35° below zero, at Cherry Creek. The average precipitation was 0.53, or 0.25 below normal; the greatest monthly amount, 2.40, occurred at Rosebud, and the least, trace, at Fort Meade and Ipswich.—*S. W. Glenn.*

Tennessee.—The mean temperature was 41.5°, or about normal; the highest was 71°, at Dover on the 10th, and the lowest, 10°, at Silverlake on the 24th. The average precipitation was 5.79, or about 2.00 above normal; the greatest monthly amount, 10.97, occurred at St. Joseph, and the least, 3.23, at Elizabethton.—*H. C. Bate.*

Texas.—The mean temperature for the State during the month was 5.8° below the normal. There was a general deficiency in all sections and the deficit ranged from 2.7° to 12.1° over the panhandle and north Texas, from 3° to 9° over east, central, and southwest Texas, and from 1.1° to 12.6° over west Texas and the coast district, with the greatest in the vicinity of Cuero. The highest was 87°, at Jasper on the 8th and 13th, and the lowest, 1° below zero, at Amarillo on the 3d. The average precipitation for the State during the month was 0.10 above the normal. There was a general excess over the eastern part of the State and a deficiency over the western portion. The excess ranged from 0.54 to 3.00 over east Texas, and from 0.12 to 4.29 over the eastern portions of north Texas and the coast districts, except at Galveston, where there was a deficiency of 1.43. The deficiency ranged from 0.17 to 1.76 over the panhandle, central, west, and southwest Texas and the western portions of north Texas and the coast district, with the greatest deficiency at Coleman. The greatest monthly amount, 11.02, occurred at Colmesneil, while none fell at Kent.—*I. M. Cline.*

Utah.—The mean temperature was 22.7°; the highest was 68°, at Pinto on the 12th, and the lowest, 19° below zero, at Loa and Scipio on the 20th. The average precipitation was 1.16; the greatest monthly amount, 2.80, occurred at Huntsville, and the least, 0.06, at Loa.—*J. H. Smith.*

Virginia.—The mean temperature was 39.5°, or slightly above normal; the highest was 74°, at Ashland and Spottsville on the 11th, and the lowest, 2°, at Monterey on the 24th. The average precipitation was 3.39, or 0.31 above normal; the greatest monthly amount, 4.81, occurred at Burkes Garden, and the least, 1.75, at Goshen.—*E. A. Evans.*

Washington.—The mean temperature was 35.8°, or slightly below normal; the highest was 63°, at Kennewick on the 8th, and the lowest, 12° below zero, at Waterville on the 17th and 18th. The average precipitation was 9.21, or 2.46 above normal; the greatest monthly amount, 29.20, occurred at Union City, and the least, 1.21, at Kennewick.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 37.3°, or slightly above normal; the highest was 72°, at Nuttallburg on the 9th, and the lowest, 4° below zero, at Beverly on the 25th. The average precipitation was 4.00, or about 1.00 above normal; the greatest monthly amount, 6.79, occurred at Buckhannon, and the least, 2.05, at Uppertract.—*H. L. Ball.*

Wisconsin.—The mean temperature was 16.4°, or 4.5° below normal; the highest was 54°, at Milwaukee on the 10th, and the lowest, 29° below zero, at Osceola on the 2d. The average precipitation was 1.11, or 0.27 below normal; the greatest monthly amount, 2.69, occurred at Watertown, and the least, 0.10, at Spooner.—*W. M. Wilson.*

Wyoming.—The mean temperature was 19.5°, or 6.5° below normal; the highest was 70°, at Wheatland on the 31st, and the lowest, 33° below zero, at Sheridan on the 16th. The average precipitation was 0.91, or 0.27 above normal; the greatest monthly amount, 2.14, occurred at Fort Washakie, and the least, 0.24, at Lusk.—*W. S. Palmer.*

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The rise in the lower Mississippi which began in November continued very slowly during the first three weeks of December. During the last week of the month a sharper rise occurred, bringing the river to about its normal condition on the 31st at Cairo and Memphis. At Vicksburg the stage was still 8 feet below its normal height, but rising steadily.

The upper Mississippi and Missouri were closed by ice at the end of the month, and there has been practically no navigation on them since the last of November. The Ohio remained open and navigation was good, with scarcely any ice. The large coal shipments of November down the Ohio were duplicated. The Arkansas and Red continue very low, although slight rises toward the end of the month enabled a partial resumption of navigation.

During the last week of the month navigation was closed by ice in the Hudson. The navigable streams of the South Atlantic and East Gulf States have risen to fairly good stages and a marked increase in freighting has taken place.

The highest and lowest water, mean stage, and monthly range at 114 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on the accompanying chart, V. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

The following résumé of river stages and conditions of navigation in the respective streams is compiled from reports by the officials of the Weather Bureau at various river stations and section centers:

Hudson River. (Reported by A. F. Sims, Albany, N. Y.)—Heavy rains on the watershed during the early days of the month caused the Hudson River to rise 7.1 feet above mean low water by the morning of the 6th. The prevailing wind was from the north, and the river fell 2 feet by the morning of the 7th. No ice was present in the river on that date. A dense fog overhung the valley during the mornings of the 8th and 9th. On the 10th all up-bound boats from New York were delayed in consequence of fog. On the 14th all streams in eastern New York were high, and a special warning to the effect that the Hudson would overflow its banks was made public. The river rose 20 inches in three hours at Albany during the 15th and flooded Quay street; on the 16th a stage of 10.5 feet above mean low water was reached; and by the 16th there was 1 foot of water on the lower streets south of Madison Avenue. The *Dean Richmond* could not make her regular landing at Steamboat square, but tied up at the high dock at the foot of Gansevoort street. The river ran like a mill-race during the 16th, and the swollen current brought down huge masses of debris that had been piled up along shore. Merchants had prepared for such a freshet by removing goods out of reach of water. Trains ran through a foot of water on Quay street during the afternoon of the 15th. At 9:45 a. m. on the 15th there were 73 inches of water passing over the State dam at Troy, the highest record for December in many years. The mills in the northern part of Troy were partly shut down on account of high water.

The Hudson receded and was within its banks by the 17th. On the 20th the *Dean Richmond* left for New York City and navigation was brought to a close; the upper Hudson froze over on the 24th. The condition of the river for several days prior to its close was not favorable for a permanent winter freeze, as the waters swollen by the recent rains, had covered the various wharves that line both sides of the stream and, at the time ice began to form, was too high to allow the dirt to settle. The current was still rapid and the ice formed was lumpy, and barrier after barrier of drift ice found lodgment at various points along the river. Navigation on the lower Hudson closed on the 27th.

Susquehanna River. (Reported by E. R. Demain, Harrisburg, Pa.)—The rainfall within the drainage area of the Susquehanna River was above the average and, being fairly well distributed through the month, the good stages of water in the streams at the end of November were maintained throughout the greater part of December, but a majority of the stations report lower stages on December 31 than existed at the beginning of the month. The conditions as to rainfall and the quantity of water discharged differed materially from those of December, 1896. For that month the average gauge reading of twelve stations was 2.4 feet, and the average rainfall of sixteen stations 0.89 inch, while for December, 1897, the average gauge reading of fifteen stations was 3.2 feet and the average rainfall of sixteen stations 3.20 inches. The dates of the closing of streams are reported as follows: At Sinnemahoning, the 22d; at Farrandsville, the 24th; at Mifflin, the 25th; at Wilkesbarre, the 25th; and at Williamsport, the 25th. A sudden rise of 2.3 feet at Towanda on the 28th was supposed to be due to an ice gorge below, as no precipitation sufficient to cause such a decided rise was known to have occurred above this point. Slush ice appeared in the river at Keating on the 23d and at Harrisburg on the 24th, and continued running, in decreasing quantities, till the end of the month.

Rivers of the South Atlantic States. (Reported by E. A. Evans, Richmond, Va.; C. F. von Herrman, Raleigh, N. C.; L. N. Jesunofsky, Charleston, S. C.; D. Fisher, Augusta, Ga.; and J. B. Marbury, Atlanta, Ga.)—The volume of water in the James River and its tributaries was about normal throughout the month. The rainfall over the river basin, while generally a little in excess of the average, showed no marked departures, and as the soil was not frozen a considerable portion of the downpour was absorbed. The water remained at about the zero of the gauge until the 15th, when general rains occurred over the basin, producing a rise to 1.5 foot on the following day. This was the maximum stage for the month. The river then declined slowly to its former level, which height it maintained with unimportant fluctuations during the remainder of the month. Navigation was unimpeded throughout the month, and, while some ice formed in shallow water above the falls during the last decade, it was not sufficient to be of consequence. With a normal amount of precipitation for the month, falling chiefly from the 2d to the 4th, 12th to 15th, and 19th to 22d, somewhat higher river stages were maintained in the North Carolina streams during December. Moderate increase in the volume of flow occurred about the 7th, 18th, 24th, and 28th. On the latter date the highest stage, 10 feet above the zero of gauge, occurred at Fayetteville, on the Cape Fear. The Cape Fear maintained a mean stage 2 feet higher than during November, while there was no increase in the mean stage of the Dan. There was very little formation of ice during the month, and has been practically no accumulation of snow in the mountains.

Navigation on the streams of South Carolina during December was much improved over that of the preceding month. Though slightly deficient in amount, there was a uniform distribution of rain over the drainage areas, which caused most of the streams to rise slowly, and sufficiently for purposes of traffic, between the 1st and 24th. The widespread and copious precipitation of the 25th and 26th produced additional rises, so that by the end of the month the streams had reached their normal heights, and navigation was fully resumed. A comparison with the season of 1896 shows that the resumption of navigation this year was twenty-seven days later than in 1896. The Pedee at Cheraw was unnavigable from the 5th to the 22d.

The lumber season was at its height during the latter part of the month. There are thousands of cypress log and timber rafts lying along the banks of the streams awaiting favorable rises. A few light rafts were floated down the Pedee, the Little Pedee, the Waccamaw, and the Wateree, during the latter part of the month, but not with the success expected, for several rafts stuck fast in the shallow water upon the lower Black and lower Waccamaw rivers, and had to be pulled off by towboats. Twenty-three rafts of undressed lumber, the first this season, arrived at Charleston between the 14th and 21st from Edisto and other landings along the Edisto River.

While steamboat men and merchants are hopeful of business during the coming steamboat season, yet the great loss occasioned by low water during November and the first part of December has proven a great setback to them. Considerable cotton was transported by rail, which otherwise would have gone by steamer. The steamboat companies report a great decrease in the fertilizer business this winter and a corresponding increase in the rice trade and in naval stores.

There was a marked deficiency of rainfall during the month over the greater portion of the Savannah watershed, but even with this shortage a much better boating stage was maintained than prevailed during the previous three months. The lowest gauge reading occurred on the 13th, and was more than sufficient for all navigation purposes, and no difficulty was encountered at any time in making regular trips by the river boats. With little cotton remaining to be shipped and the merchants of Augusta pretty well stocked for the winter, only one boat was used for the accommodation of river traffic, the other regular steamer being withdrawn until the commencement of the spring trade.

More than the normal amount of rain fell in the drainage basins of northwest Georgia, but, owing to a very dry condition of the soil, comparatively little of the water reached the rivers, and low stages continue. The rainfall in the middle and southern sections of the State was very light. The rivers are all below the boating stage, and no business has been done in that line.

Mobile River and branches. (Reported by F. P. Chaffee, Montgomery, Ala., and W. M. Dudley, Mobile, Ala.)—The Alabama River was too low for traffic during the first decade of the month, but heavy rains during that period caused a general and gradual rise in the upper rivers, which was felt as far down as Selma by the 10th, after which well distributed rains at intervals of a few days caused navigable stages in the rivers of this system during the remainder of the month. On the 16th the first steamer since August 1 arrived at Montgomery from Selma and down-river points, and a large quantity of cotton was freighted by steamer between Montgomery and Mobile during the latter half of the month.

The moderate, general rain, which fell on the 2d, caused rises in the upper Tombigbee. Heavy rains on the 3d and 4th maintained the rise to the 6th, when falls over the headwaters were noted, but the rise continued to the 8th from Demopolis to the Gulf. General and heavy rain fell on the 13th and 14th, but had only a slight effect on the river stages, as the changes were very small from the 14th to the 21st, when the heavy rain which occurred on the mornings of the 21st, 22d, and 23d caused marked rises in the Warrior and Tombigbee rivers. A fall began on the 26th and continued to the close of the month.

The rivers at all points got above the zero of gauge during the early part of the month and so continued, giving as a rule good navigable stages, and a large business was done by the boats. On each trip they brought to Mobile immense cargoes of cotton, being loaded to their fullest capacity, to return with merchandise for the people living in the upper country.

Ohio River and minor branches. (Reported by F. Ridgway, Pittsburg, Pa.; H. L. Ball, Parkersburg, W. Va.; S. S. Bassler, Cincinnati, Ohio; S. P. Gresham, Louisville, Ky.; and P. H. Smyth, Cairo, Ill.)—The month of December was an exceptionally favorable one for navigation, a sufficient stage for packet traffic being maintained at all times on the Ohio, Alleghany, and Monongahela rivers, which were absolutely free from ice, except during the last few days of the month. There were two excellent boating stages which sufficed for the transportation of all the coal in the Pittsburg harbor and Monongahela river. The shipments of coal during the month were 10,560,000 bushels. During this period the Alleghany and its tributaries were also cleared of their timber product, all of which was run in safety to the market at Pittsburg. About the end of the month the Alleghany showed a tendency to close with ice at various points which, considering its heavy output of ice generally, will prove beneficial to the Ohio River navigation. While the conditions have thus far favored navigation they have been correspondingly unfavorable to the progress of river improvement in this vicinity. With the continuation of open weather the heavy snow now covering the Alleghany and Monongahela valleys should maintain the present water conditions for a considerable period.

At Wheeling the lowest stage during the month, 6.2 feet on the 6th, was followed by a quick, light rise which continued until the 9th. The river began rising again on the 13th and reached a maximum stage of 18.9 feet on the 17th. After this there was a slow fall to 6.9 feet during the closing days of the month.

At Parkersburg excellent boating stages were had throughout the month, the range of water being from 18.0 feet on the 19th to 7.7 feet during the last three days of the month. Ice began running on the 27th, and on the 28th and 29th was sufficiently heavy to impede navigation to some extent.

At Cincinnati and Louisville there was a good, navigable stage of water during the entire month, and river business was active. An average depth of water of 8 feet obtained in the canal at Louisville, ranging from 6.0 feet on the 1st to 10.1 feet on the 23d.

At Evansville from the 1st to the 20th the river alternately rose and fell every three or four days, making an uncertain stage with little variation. A rise from the upper river reached this point on the 20th, and during the subsequent five days the stage increased 9 feet. A fall set in on the 26th and continued at the close of the month.

At Paducah and Cairo the river improved slightly during the first and second decades. During the night of the 21st a rise out of the Tennessee reached Paducah, starting the river up at that point. By the 22d combined rises out of the Cumberland, Tennessee, and upper Ohio were passing Paducah and Cairo. This rise continued at Paducah until the 27th and at Cairo until the 28th. At the close of the month the Ohio was falling somewhat rapidly from Evansville down. A good boating stage obtained at Cairo during the second half of the month. Large tows of coal from the upper river, bound for the south, passed Cairo on the 21st, 26th, and 30th.

Tennessee and Cumberland Rivers. (Reported by L. M. Pindell, Chattanooga, Tenn., and H. C. Bate, Nashville, Tenn.)—General and heavy rain fell over the Tennessee River basin from the 2d to the 4th, causing a rise which opened navigation on the 5th, but it was closed again on the 9th. Light rain occurred at intervals from the 8th to 22d, which opened navigation again on the 20th. A good boating tide continued through the balance of the month, but at its close the river was falling with indications of a further closing of navigation. On December 6 a fleet of rafts arrived at Chattanooga from the Clinch River. Light driftwood passed on the 21st and 23d, and heavy drift on the 22d. The activity on the water front was marked in comparison with what it had been for the past four months. The rivermen think that the conditions are favorable for a continued boating tide.

The month opened with the Cumberland River low and navigation closed, but good rains on the 2d, 3d, and 4th were responsible for a material rise and the opening of navigation from the mouth of the river to Carthage and Celina. A rapid decline in the river shut off navigation above Nashville from the 10th to the 20th, when another good rain opened the river to the head of navigation long enough for one boat to make the trip. After the 24th navigation was closed above Celina, but the stage of water allowed one boat to leave for that point on the last day of the month.

Mississippi River and minor branches. (Reported by P. F. Lyons, St. Paul, Minn.; M. J. Wright, Jr., La Crosse, Wis.; G. E. Hunt, Davenport, Iowa; F. Z. Gosewisch, Keokuk, Iowa; H. C. Frankenfield, St. Louis, Mo.; P. H. Smyth, Cairo, Ill.; S. C. Emery, Memphis, Tenn.; R. J. Hyatt, Vicksburg, Miss.; and R. E. Kerkam, New Orleans, La.)—The rivers of Minnesota have remained frozen over during all of the month. The ice field in the Mississippi River in front of St. Paul was noted regularly at short intervals, and, judging from the rise and sag of the same, the average gauge reading for the month would be about 3.7 feet if it were possible to make gauge readings. Reports from commercial travelers and others justify the statement that there was little snow on the ground at the end of the month over the watersheds of the Minnesota and Upper Mississippi rivers.

The Mississippi River at La Crosse was completely closed on the 1st of December and remained closed during the entire month. Last season the river was not closed until January 24, nearly two months later than the present season. The early closing of the river this season was due to the low temperature which prevailed during the last four days of November, although the mean temperature for that month was normal and 6° above the mean temperature for November, 1896. The mean temperature for December was 17°, which is 6° below the normal and 9° below the mean for December, 1896. These conditions have resulted in a good ice crop, the quality of which is said to be the best for several years. The ice harvest began on the 28th. There was a deficiency of 0.64 inch in the monthly precipitation, with 3.4 inches of snow on the ground at the end of the month. An ice road was laid out on the river between Brownsville, Minn., and La Crosse on the 7th, and has greatly facilitated travel and trade.

From La Crosse to Leclaire the river was frozen during the entire month. At Davenport, though the river was more or less obstructed by ice, the ferryboat ran from the 10th to the 16th, and the ice did not stop running at the bridge until the morning of the 21st. The river remained open along the upper portion of the city until the 23d. On the 27th the ice was about a foot thick. At Muscatine, Iowa, the river was frozen from the 7th to the 13th, and again from the 16th to the end of the month. At Davenport the river was slightly higher than the average at the time of freezing, and the time of freezing was, perhaps, slightly earlier than usual, though near the average.

A decided fall in the stage of the river at Keokuk was caused by anchor ice forming on the Des Moines Rapids, and on the 6th the river was reported closed by ice at Burlington, Iowa, causing very low water to continue throughout the month. Heavy, broken, gorge ice was running at Keokuk on the 12th, and on the 16th the river was full of newly formed ice. The channel remained open until the night of the 22d, but the shore ice was 5 inches thick on the 20th. The river was closed at the end of the month with ice varying from 5 to 9 inches.

During the month the waters in the rivers of the St. Louis district were subjected to frequent and irregular fluctuations, due to the effects of the ice gorges and blockades above. The tendency, where the rivers were open, was toward a general fall, but this was often interrupted by the formation of local blockades at various points. Thus, at St. Louis there was an extreme range of 3.9 feet, but from the 1st to the 31st the net loss of water was only 1.6 foot. The rise during the last few days of the month was probably due to a slight gorge reported below, at Wittenberg. Ice, either floating or gorged, was present in all the rivers during practically the entire month. It commenced running past Grafton, Ill., on the 2d, and was first noticed at St. Louis on the 6th, four days later than in 1896. At the end of the month the Mississippi River was practically blocked as far south as the mouth of the Missouri. The Illinois River was blocked at Beardstown on the 17th and at Peoria and Grafton on the 18th, and still remains in that condition.

Ice cutting commenced as far south as Quincy on the 21st and at Alton on the 22d, but was suspended as far north as Burlington a few days later, owing to softening of the ice caused by rising temperature. Navigation north of St. Louis was suspended on the 3d; from St. Louis southward navigation was practically suspended on the 18th. During the month the wreck of the towboat *Dolphin No.* 2, which was sunk by the tornado of May 27, 1896, was almost entirely removed by the United States Engineer Corps, and there is at the present stage of the river about 9 feet of water over the remaining portion of the wreck.

From St. Louis to Cairo the river fell during the first decade of the month, followed by a slight rise until the morning of the 17th. A sharp fall set in on the 19th and continued until the 24th, bringing the river down to a lower stage than there is any previous record of. At Chester the gauge reading on the 24th and 25th was 1.9 foot below the zero of gauge. The previous lowest record at Chester was 1.8 foot below zero on January 15, 1892. At Chester the river was full of floating ice on the 5th and continued so until the 9th. A second run of ice commenced at Chester on the 18th and continued until the 28th. Light ice commenced running at Cairo during the afternoon of the 21st; filled the river during the night, and continued running until the night of the 24th. A second run of ice commenced passing Cairo on the 31st. The ferry crossing the Mississippi between Cairo and Greenfield, Mo., suspended on the 24th on account of ice. The last regular freight boat from St. Louis arrived at Cairo on the 4th. On the 12th and 18th small tows arrived from St. Louis. After the 18th navigation was entirely suspended between Cairo and St. Louis. Several steamers and towboats are still laid up at Cairo on account of low water in the Mississippi.

Between Cairo and Helena the river remained at a moderately low stage with slight fluctuations up to the 22d. On that date the stage at Memphis was 5.1 feet, an increase of only 2 feet since the 1st. A rise coming out of the Ohio was first felt at Cairo on the 22d, and reached a maximum of 19.3 feet at that place on the 28th. This swell, which at Cairo amounted to 10.4 feet, caused a rise of 7.1 and 10.4 feet, respectively, at Memphis and Helena, and culminated at Memphis on the 3d day after the crest passed Cairo. By this rise the stage at Memphis was increased to 12.4 feet, and that at Helena to 16.4 feet. This is a good boating stage, and is being taken advantage of by coal dealers in bringing down some large fleets of coal barges that have been held back by the low water. The monthly average stage for December at the Memphis gauge was 5.5 feet, which is about 5.5 feet below the normal reading, and a lower average has seldom occurred. It was nearly 6 feet below the December average for 1896. Owing to the low water in the tributaries navigation on those streams was practically suspended during the month except to very small boats.

Good boatable water was reported during the greater portion of the month between Helena and Vicksburg, and river traffic, both freight and passenger, was very good during the month. Traffic on the upper White River was suspended at the close of the month. The rise in the Mississippi put all sandbars under, and greatly benefited steamboats, which are still coming in heavily loaded with cotton. Many of the sandbars caused considerable trouble during low water, especially the bar in front of Greenville. Boats are having less trouble in unloading as the high banks are not so steep. Considerable drift passed down the Mississippi during the past two weeks. Good traffic was reported on the Yazoo and tributaries since about the 7th, when sufficient water had appeared to allow boats to cross the bar at the confluence with the Mississippi. Heavy rains afforded sufficient water for all river interests on the Yazoo and its tributaries, the river rising above zero on the gauge at Yazoo City on December 3. At Vicksburg the river rose above zero on the 4th.

The Mississippi between Vicksburg and New Orleans rose quite rapidly during the first and last decades of the month. Below New Orleans the fluctuations were not very marked, the range for the month reaching barely 2 feet.

Missouri River. (Reported by L. A. Welsh, Omaha, Nebr.; P. Connor, Kansas City, Mo.; and H. C. Frankenfield, St. Louis, Mo.)—At and above Omaha the Missouri River and its tributaries remained frozen throughout the month. An average thickness of ice of about 10 inches was maintained during the month at Omaha, the ice being thickest on the 18th, when a measurement showed 15 inches. The river froze at Plattsmouth on the 1st and continued frozen the remainder of the month. The Burlington and Missouri River Railroad Company did considerable filling and mattressing at the east end of the Burlington bridge in the earlier part of the month. Eight inches of snow on the ground were reported from that point on the 3d. The river was reported frozen throughout the month at St. Joseph, Mo.

The Missouri River froze at Kansas City on December 5, and opened again on the 7th, remaining open until the 20th, when it again closed until the 26th, after which it was open until the end of the month, with a slightly higher stage than at the beginning of the month. The ice was thickest on the 20th, its thickness then being 5 inches. On neighboring lakes it was from 7½ to 8½ inches thick.

Ice commenced running past Hermann, Mo., on the 2d. Temporary ice blockades occurred at Glasgow and Washington, Mo., on the 20th, and at Hermann on the 25th. The Osage River was also blocked at Bagnell, Mo., on the 22d. Navigation has been suspended on the lower Missouri since the 4th, and at the end of the month the river is blocked by ice at its mouth.

Arkansas River. (Reported by J. J. O'Donnell, Fort Smith, Ark., and F. H. Clarke, Little Rock, Ark.)—The Arkansas River west of Fort Smith was below a navigable stage during the month, and continued about stationary until the 10th when precipitation caused a rise at Fort Smith from 0.9 foot on the 11th to 1.9 on the 12th, the river then falling until the 17th. Heavier precipitation caused a rise from 1.0 foot on the 16th to 2.5 feet on the 18th, this being the highest stage during the month and since August 31. After this rise the river was generally falling slowly until the end of the month, the highest rise being 0.3 foot on the 28th.

The lower Arkansas River continued too low for navigation to the 16th, when it had risen sufficiently to make navigation possible between Little Rock and Dardanelle, but below Little Rock the river continued low until the 26th, on which date the first boat from the mouth of the river reached Pinebluff. The lower river continued navigable the rest of the month. The average stage of the river was higher at Little Rock during the month than it has been since September. The river remained clear of ice throughout the month.

Red River. (Reported by C. Davis, Shreveport, La., and R. E. Kerkam, New Orleans, La.)—Moderately heavy rains in the watershed of the Red River from the 17th to the 21st caused the stream at Shreveport to reach and pass the zero of gauge on the 25th, it having been below that point since the first week of September. Consequent upon these conditions, navigation was resumed to a considerable extent near the end of the month. Heavy local rains in the valley of the extreme lower Red at various times caused a few marked fluctuations in the gauge readings at Alexandria. The Ouachita River rose during the greater part of the month, making navigation practicable during the last half of the month, and the stage at Monroe, La., was above 16 feet during the closing days of December.

Rivers on the Pacific Coast. (Reported by W. H. Hammon, San Francisco, Cal.; J. A. Barwick, Sacramento, Cal.; and B. S. Pague, Portland, Oreg.)—The rivers of California continued to fall slowly until the 8th when, owing to the rains on the 8th and 9th, there was a slight rise which reached its crest on the 9th. From this time to the end of the month the rivers fell slowly and stood at about the same stage on the 31st as they did on the 1st.

Owing to the lack of the usual rains the Sacramento River, at Sacramento, has remained comparatively low. Its stage was 10 feet at the beginning of the month, remaining nearly stationary to the 8th. A rise then set in, reaching a crest of 14.5 feet on the 9th, and afterward falling slowly to 10.3 feet at the close of the month. Low water at this point in December is not unusual as may be seen from the following tabular statement of December low waters:

Low waters in December at Sacramento, Cal.

Year.	Stage.	Year.	Stage.
	Feet.		*Feet.*
1880	7.6	1886	7.8
1881	7.7	1887	7.5
1883	7.0	1891	7.4
1884	7.5	1094	9.2

The Columbia, Snake, Willamette, and tributary rivers had nearly normal stages during the month. Owing to the influence of chinook winds on the 5th to 10th, and 26th to 29th, the rivers had a rise. From the 12th to 15th there was some danger of the lower docks in Portland flooding, but the river fell. During the second chinook, which was accompanied by heavy rain in western Washington, the small streams in that section rapidly flooded and much local damage was done, especially to railroad property. Navigation on the Willamette, from Portland 140 miles south, upon the Columbia, and upon the Snake was uninterrupted. There has been no freeze-up yet east of the Cascades, except in northern Idaho and northeastern Washington, and boats were in regular service.

Heights of rivers above zeros of gauges, December, 1897.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn. †	1,957	14	.....	.....	.....	.....	.....	.....
Reeds Landing, Minn.	1,887	12	1.0	22	0.2	4,10	0.6	0.8
La Crosse, Wis. †	1,822	10	.....	.....	.....	.....	.....	.....
North McGregor, Iowa	1,762	18	3.1	15-17	1.8	4	2.5	1.3
Dubuque, Iowa †	1,702	15	.....	.....	.....	.....	.....	.....
Leclaire, Iowa †	1,612	10	.....	.....	.....	.....	.....	.....
Davenport, Iowa [a]	1,596	15	4.3	20	— 0.5	1	1.1	4.8
Keokuk, Iowa [b]	1,466	14	0.3	17	— 2.0	8	—0.4	2.3
Hannibal, Mo	1,405	17	1.8	29-31	— 1.4	8	0.5	3.2
Grafton, Ill	1,307	23	5.2	31	0.1	9,10	2.5	5.1
St. Louis, Mo.	1,264	30	3.5	1	— 0.4	24	1.0	3.9

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River—Cont'd	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Chester, Ill.	1,189	30	1.8	1	— 1.9	24, 25	—0.4	3.7
Cairo, Ill	1,073	40	19.3	28	6.9	7	10.7	12.4
Memphis, Tenn	843	33	12.2	31	5.2	1	5.5	9.0
Helena, Ark	767	44	16.4	31	3.3	1	6.7	13.1
Arkansas City, Ark.	635	42	14.6	31	1.5	1	5.5	13.1
Greenville, Miss	595	40	11.1	31	1.3	1	4.3	9.8
Vicksburg, Miss	474	41	7.9	31	— 0.8	2	3.7	8.7
New Orleans, La	108	16	4.1	13	2.3	5,6	3.1	1.8
Arkansas River.								
Wichita, Kans.	720	10	1.7	14	0.8	1–12, 29, 30	1.1	0.9
Fort Smith, Ark.	345	22	2.5	18	0.6	7–9	1.4	1.9
Dardanelle, Ark.	250	21	2.6	19	— 0.6	1, 5–12	0.6	3.2
Little Rock, Ark.	170	23	4.9	22	1.2	1–9	2.5	3.7
White River.								
Newport, Ark	150	26	4.7	24	0.4	1–3	2.0	4.3
Des Moines River.								
Des Moines, Iowa †	150	19	.....	.....	.....	.....	.....	.....
Illinois River.								
Peoria, Ill.	135	14	4.5	1	4.1	27–31	4.2	0.4
Missouri River.								
Bismarck, N. Dak.	1,201	14	4.6	29	2.7	12, 13	3.5	1.9
Pierre, S. Dak. †	1,006	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa †	676	19	.....	.....	.....	.....	.....	.....
Omaha, Nebr. †	561	18	.....	.....	.....	.....	.....	.....
St. Joseph, Mo.	373	10	0.7	24–26	— 2.7	6–8	—0.9	3.4
Kansas City, Mo. *	280	21	5.2	30	2.0	7, 8	3.5	3.2
Boonville, Mo.	191	20	4.5	1	0.9	20	2.6	3.6
Hermann, Mo.	95	21	— 0.7	1	— 3.6	22	—2.3	2.9
Ohio River.								
Pittsburg, Pa	966	22	13.7	17	3.4	31	7.2	10.3
Davis Island Dam, Pa.	960	25	13.7	17	5.5	5, 31	8.5	8.2
Wheeling, W. Va.	875	36	18.9	17	6.2	6	10.6	12.7
Parkersburg, W. Va.	785	35	18.0	19	7.7	29, 30	11.6	10.3
Point Pleasant, W. Va.	703	36	19.1	22	6.6	31	12.2	12.5
Catlettsburg, Ky	651	50	22.8	23	9.0	31	15.0	13.8
Portsmouth, Ohio	612	50	23.2	23	10.2	31	15.7	13.0
Cincinnati, Ohio	499	45	25.5	22	12.0	1	17.8	13.5
Louisville, Ky.	367	24	10.1	23	6.0	1	8.0	4.1
Evansville, Ind	184	30	18.9	26	7.8	4	12.5	11.1
Paducah, Ky.	47	40	18.0	27	4.8	6	9.5	13.2
Alleghany River.								
Warren, Pa	177	7	5.4	16	1.2	5	2.7	4.2
Oil City, Pa	123	13	7.0	16	2.2	4, 5	3.5	4.8
Parkers Landing, Pa.	73	20	8.0	16	1.7	31	3.7	6.3
Freeport, Pa.	26	20	13.1	16	3.8	31	6.9	9.3
Conemaugh River.								
Johnstown, Pa.	64	7	3.9	16	1.7	28, 29	2.5	2.2
Red Bank Creek.								
Brookville, Pa.	35	8	2.5	12	1.0	2–4, 29, 31	1.7	1.5
Beaver River.								
Ellwood Junction, Pa.	10	14	3.6	16	0.1	7–10	1.1	3.5
Cumberland River.								
Burnside, Ky	434	50	11.8	22	0.2	1, 2	2.7	11.6
Carthage, Tenn.	257	30	12.8	24	0.8	2	4.3	12.0
Nashville, Tenn	175	40	16.4	24	1.3	1	6.6	15.1
Great Kanawha River.								
Charleston, W. Va.	61	30	8.0	22	3.7	29, 30	6.3	4.3
New River.								
Hinton, W. Va.	95	14	3.0	23	1.2	14	1.8	1.8
Licking River.								
Falmouth, Ky.	30	25	6.5	21	1.8	13, 14	2.9	4.7
Miami River.								
Dayton, Ohio	69	18	3.4	18	1.1	29	1.9	2.3
Monongahela River.								
Weston, W. Va	161	18	9.6	5	— 1.0	10, 11	1.2	10.6
Fairmont, W. Va	119	25	10.5	6	1.1	3, 4	3.7	9.4
Greensboro, Pa.	81	18	17.0	5	7.7	3, 4, 13, 14	9.8	9.3
Lock No. 4, Pa.	40	28	20.6	6	7.2	4	10.6	13.4
Cheat River.								
Rowlesburg, W. Va.	36	14	9.0	5	2.5	2, 3	4.1	6.5
Youghiogheny River.								
Confluence, Pa.	59	10	5.6	5	1.8	3	3.3	3.8
West Newton, Pa.	15	25	6.5	6	0.8	4	2.4	5.7
Muskingum River.								
Zanesville, Ohio	70	20	9.6	17	6.8	4, 10, 11	7.8	2.8
Tennessee River.								
Knoxville, Tenn.	614	29	3.5	23, 24	0.5	2, 3	1.7	3.0
Kingston, Tenn	534	25	5.0	22	0.0	1–3	1.3	5.0
Chattanooga, Tenn.	430	33	10.2	23	1.0	1	3.8	9.2
Bridgeport, Ala	390	24	8.2	24	0.0	1	2.4	8.2
Florence, Ala.	220	16	8.7	25	— 0.2	1, 2	2.9	8.9
Johnsonville, Tenn.	94	21	13.3	25, 26	0.0	1, 2	5.2	13.3

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Clinch River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Speers Ferry, Va.	156	20	1.5	23	— 0.7	1	0.1	2.2
Clinton, Tenn	46	25	7.0	23	2.0	1, 2	3.9	5.0
Wabash River.								
Mount Carmel, Ill.	50	15	7.4	20, 21	2.2	11	4.1	5.2
Red River.								
Arthur City, Tex.	688	27	3.6	20	2.1	1–3, 14–18	2.5	1.5
Fulton, Ark	565	28	4.6	31	1.0	1–10	2.1	3.6
Shreveport, La.	449	29	1.8	31	— 2.1	5–10	—1.1	3.9
Alexandria, La	139	33	6.3	27	— 2.8	1, 2	1.7	9.1
Atchafalaya Bayou.								
Melville, La	100*	31	14.4	27	2.3	1	9.2	12.1
Ouachita River.								
Camden, Ark.	340	39	15.0	24	3.5	1–3	6.6	11.5
Monroe, La	100	40	16.6	30	0.5	1, 2	6.5	16.1
Yazoo River.								
Yazoo City, Miss.	80	25	11.5	27	— 2.1	1, 2	5.9	13.6
Chattahoochee River.								
Columbus, Ga.	140	20	2.6	15	1.3	22, 24	1.8	1.3
Flint River.								
Albany, Ga.	80	20	3.2		1.1	1	2.1	2.1
Cape Fear River.								
Fayetteville, N. C.	100	38	10.0	28	3.0	14	5.1	7.0
Columbia River.								
Umatilla, Oreg	270	25	5.8	12–14	4.0	24, 25	5.0	1.8
The Dalles, Oreg.	166	40	10.0	14	5.9	26	7.9	4.1
Willamette River.								
Albany, Oreg	99	20	17.5	16	6.0	24, 25	10.4	11.5
Portland, Oreg	10	15	15.1	14, 15	6.0	23, 24	10.2	9.1
Edisto River.								
Edisto, S. C	75	6	3.8	31	2.3	16	2.8	1.5
James River.								
Lynchburg, Va.	257	18	1.7	16	— 0.1	1, 2	0.7	1.8
Richmond, Va.	110	12	1.5	16	— 0.1	2–4	0.3	1.6
Alabama River.								
Montgomery, Ala.	265	35	5.3	25	— 0.7	2	2.2	6.0
Selma, Ala.	212	35	6.0	28	— 1.6	1	2.3	7.6
Coosa River.								
Gadsden, Ala [d]	144	18	6.3	24	— 0.2	1	2.2	6.5
Tombigbee River.								
Columbus, Miss.	285	33	11.5	23	— 3.6	1	5.0	15.1
Demopolis, Ala.	155	35	27.4	27	— 2.1	1, 2	11.4	29.5
Black Warrior River.								
Tuscaloosa, Ala.	90	38	31.0	23	— 1.3	1	8.8	32.3
Pedee River.								
Cheraw, S. C.	145	27	4.5	28, 29	1.1	14	2.4	3.4
Black River.								
Kingstree, S. C.	60	12	5.3	31	2.4	6–10	3.4	2.9
Lumber River.								
Fairbluff, N. C.	10	6	1.7	31	0.2	1	0.7	1.5
Lynch Creek.								
Effingham, S. C.	35	12	5.7	28	3.3	1	4.0	2.4
Potomac River.								
Harpers Ferry, W. Va.	170	16	5.3	16	1.3	4	2.5	4.0
Roanoke River.								
Clarksville, Va	155	12	0.4	23	0.1	3–21, 27–31	0.1	0.3
Sacramento River.								
Redbluff, Cal.	241	23	7.2	8	0.4	1, 2	2.3	6.8
Sacramento, Cal.	70	25	14.9	13	9.7	6, 7	11.7	5.2
Santee River.								
St. Stephens, S. C.	50	12	6.1	3	1.4	17	3.2	4.7
Congaree River.								
Columbia, S. C.	37	15	2.2	23	1.2	31	1.6	1.0
Wateree River.								
Camden, S. C	45	24	6.0	28	3.0	13	4.1	3.0
Savannah River.								
Augusta, Ga	130	32	7.9	1	5.9	13	6.9	2.0
Susquehanna River.								
Wilkesbarre, Pa.	178	14	9.0	17, 18	3.0	{2–6, 11–} {13, 24–31}	4.5	6.0
Harrisburg, Pa.	70	17	8.2	18	2.5	31	4.6	5.7
Juniata River.								
Huntingdon, Pa	80	24	6.0	15	3.5	2–4	4.0	2.5
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	7.7	17	2.0	30	4.3	5.7
Waccamaw River.								
Conway, S. C	40	7	2.2	3	0.4	12, 13, 18	1.0	1.8

* Distance to Gulf of Mexico. † Frozen. * Frozen, 21–31. [b] Frozen, 23–31.
[c] Frozen, 5, 6, 20–25. [d] No observations, 17, 18.

SPECIAL CONTRIBUTIONS.

A PRELIMINARY DISCUSSION OF CERTAIN CYCLICAL CHANGES IN INDIA.

By W. L. DALLAS, Simla, India (dated December 8, 1897).

In the Indian Meteorological Memoirs, Vol. VI, it was shown by the author, and in a later volume of the same memoirs, by Mr. E. Douglas Archibald, that the effect on the course of barometric pressure of the periodic changes in the number of solar spots is to occasion a real variation in pressure of sufficient magnitude to enter into the discussion of the secular variations of weather. Having reached this conclusion, and it being evident both from present watching as well as from past records of weather, that the sun-spot influence alone was insufficient to account for the weather variations which are on record, it appeared to the writer desirable to carry the investigation a step further, and by eliminating the solar-spot influence to see whether there would then ap-

pear in the pressure curve other secular changes which would still further explain the recorded variations in the amount of rainfall, etc., in India.

The only places in India for which long series of pressure observations exist are the presidency towns of Bombay, Madras, and Calcutta. The annual mean pressure observations for these three centers are given below, together with each year's variation from the average of the whole:

TABLE I.—*Annual mean barometric pressure and variations from normal.*

Year.	Madras.		Bombay.		Calcutta.	
	Pressure.	Variation.	Pressure.	Variation.	Pressure.	Variation.
	Inches.	*Inch.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*
1841	29.835	−.008	.....	.....	.....	.....
1842	.836	−.007	.....	.....	.....	.....
1843	.846	+.003	.....	.....	.....	.....
1844	.839	−.004	.....	.....	.....	.....
1845	.853	+.010	.....	.....	.....	.....
1846	.856	+.013	29.809	−.003	.....	.....
1847	.834	−.009	.797	−.015	.....	.....
1848	.835	−.008	.805	−.007	.....	.....
1849	.819	−.024	.798	−.014	.....	.....
1850	.835	−.008	.808	−.004	.....	.....
1851	.835	−.008	.796	−.016	.....	.....
1852	.847	+.004	.805	−.007	.....	.....
1853	.848	+.005	.814	+.002	29.771	−.013
1854	.844	+.001	.804	−.008	.781	−.003
1855	.862	+.019	.824	+.012	.788	+.004
1856	.849	+.006	.806	−.006	.779	−.005
1857	.852	+.009	.808	−.004	.770	−.014
1858	.858	+.015	.812	.000	.781	−.003
1859	.850	+.007	.812	.000	.792	+.008
1860	.835	−.008	.804	−.008	.764	−.020
1861	.829	−.014	.797	−.015	.761	−.023
1862	.829	−.014	.783	−.029	.767	−.017
1863	.832	−.011	.792	−.020	.760	−.024
1864	.874	+.031	.832	+.020	.795	+.011
1865	.865	+.022	.811	−.001	.802	+.018
1866	.845	+.002	.822	+.010	.788	+.004
1867	.855	+.012	.824	+.012	.805	+.021
1868	.853	+.010	.836	+.024	.805	+.021
1869	.824	−.019	.814	+.002	.790	+.006
1870	.814	−.029	.797	−.015	.773	−.011
1871	.836	−.007	.805	−.007	.776	−.008
1872	.826	−.017	.795	−.017	.787	+.003
1873	.839	−.004	.811	−.001	.776	−.008
1874	.836	−.007	.810	−.002	.789	+.005
1875	.835	−.008	.808	−.004	.776	−.008
1876	.835	−.008	.816	+.004	.775	−.009
1877	.889	+.046	.846	+.034	.828	+.044
1878	.848	+.005	.800	−.012	.804	+.020
1879	.829	−.014	.801	−.011	.777	−.007
1880	.839	−.004	.818	+.006	.790	+.006
1881	.846	+.003	.820	+.008	.791	+.007
1882	.831	−.012	.807	−.005	.776	−.008
1883	.841	−.002	.812	.000	.774	−.010
1884	.863	+.020	.827	+.015	.792	+.008
1885	.864	+.021	.826	+.014	.800	+.016
1886	.838	−.005	.809	−.003	.790	+.006
1887	.834	−.009	.818	+.006	.781	−.003
1888	.858	+.015	.832	+.020	.785	+.001
1889	.840	−.003	.818	+.006	.784	.000
1890	.837	−.006	.814	+.002	.776	−.008
1891	.856	+.013	.834	+.022	.794	+.010
1892	.825	−.018	.790	−.022	.768	−.016
1893	.840	−.003	.815	+.003	.794	+.010
1894	.833	−.010	.809	−.003	.773	−.011
1895	.847	+.004	.819	+.007	.789	+.005
1896	.851	+.008	.819	+.007	.771	−.013
Mean	29.843	.....	29.812	.....	29.784	.....

In order to ascertain what portion of each of these variations was attributable to the variations in the number of the solar spots the following table was constructed, giving the annual variations in 11-year series for Madras, Calcutta, and Bombay, respectively.

TABLE II.—*Annual variations arranged in* 11*-year series.*

MADRAS.

Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Mean variation.
	Inch.		*Inch.*		*Inch.*		*Inch.*		*Inch.*		*Inch.*	*Inch.*
1841	−.008	1852	+.004	1863	−.011	1874	−.007	1885	+.021	1896	+.008	+.0012
1842	−.007	1853	+.005	1864	+.031	1875	−.008	1886	−.005	.....	.....	+.0082
1843	+.003	1854	−.001	1865	+.022	1876	−.008	1887	−.009	.....	.....	+.0018
1844	−.004	1855	+.019	1866	+.002	1877	+.046	1888	+.015	.....	.....	+.0156
1845	+.010	1856	+.006	1867	+.012	1878	+.005	1889	−.003	.....	.....	+.0060
1846	+.013	1857	+.009	1868	+.010	1879	−.014	1890	−.006	.....	.....	+.0024
1847	−.009	1858	+.015	1869	−.019	1880	−.004	1891	+.013	.....	.....	−.0008

TABLE II.—*Annual variations arranged in* 11*-year series*—Continued.

MADRAS—*Continued.*

Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Mean variation.
	Inch.		*Inch.*		*Inch.*		*Inch.*		*Inch.*		*Inch.*	*Inch.*
1848	−.008	1859	+.007	1870	−.029	1881	+.003	1892	−.018	.....	.....	−.0090
1849	−.024	1860	−.008	1871	−.007	1882	−.012	1893	−.003	.....	.....	−.0108
1850	−.008	1861	−.014	1872	−.017	1883	−.002	1894	−.010	.....	.....	−.0102
1851	−.008	1862	−.014	1873	−.004	1884	+.020	1895	+.004	.....	.....	−.0004

CALCUTTA.

.....	.....	.....	.....	1863	−.024	1874	+.005	1885	+.016	1896	−.013	−.0040
.....	.....	1853	−.013	1864	+.011	1875	−.008	1886	+.006	.....	.....	−.0010
.....	.....	1854	−.003	1865	+.018	1876	−.009	1887	−.003	.....	.....	+.0007
.....	.....	1855	+.004	1866	+.004	1877	+.044	1888	+.001	.....	.....	+.0132
.....	.....	1856	−.005	1867	+.021	1878	+.020	1889	.000	.....	.....	+.0090
.....	.....	1857	−.014	1868	+.021	1879	−.007	1890	−.008	.....	.....	−.0020
.....	.....	1858	−.003	1869	+.006	1880	+.006	1891	+.010	.....	.....	+.0047
.....	.....	1859	+.008	1870	−.011	1881	+.007	1892	−.016	.....	.....	−.0030
.....	.....	1860	−.020	1871	−.008	1882	−.008	1893	+.010	.....	.....	−.0065
.....	.....	1861	−.023	1872	+.003	1883	−.010	1894	−.011	.....	.....	−.0102
.....	.....	1862	−.017	1873	−.008	1884	+.008	1895	+.005	.....	.....	−.0030

BOMBAY.

.....	.....	1852	−.007	1863	−.020	1874	−.002	1885	+.014	1896	+.007	−.0016
.....	.....	1853	+.002	1864	+.020	1875	−.004	1886	−.003	.....	.....	+.0038
.....	.....	1854	−.008	1865	−.001	1876	+.004	1887	+.006	.....	.....	+.0002
.....	.....	1855	+.012	1866	+.010	1877	+.034	1888	+.020	.....	.....	+.0190
.....	.....	1856	−.006	1867	+.012	1878	−.012	1889	+.006	.....	.....	.0000
1846	−.003	1857	−.004	1868	+.024	1879	−.011	1890	+.002	.....	.....	+.0016
1847	−.015	1858	.000	1869	+.002	1880	+.006	1891	+.022	.....	.....	+.0030
1848	−.007	1859	.000	1870	−.015	1881	+.008	1892	−.022	.....	.....	−.0072
1849	−.014	1860	−.008	1871	−.007	1882	−.005	1893	+.003	.....	.....	−.0062
1850	−.004	1861	−.015	1872	−.017	1883	.000	1894	−.003	.....	.....	−.0078
1851	−.016	1862	−.029	1873	−.001	1884	+.015	1895	+.007	.....	.....	−.0048

The variations differ somewhat for the three different stations, the curve for Calcutta being less distinct and less regular than those for Madras and Bombay. It may be mentioned here that for each of the three stations the pressure variations were also determined corresponding with the exact number of the sun spots for each year, using both the maximum and the minimum years as the bases, but it was found in the end that the most regular and symmetrical returns were obtained from the simple 11-year cycle.

Table III gives the pressure variations for the 11-year periods for the three stations combined, and, by changing the signs of the variations, as is shown in the last column of the table, these departures become changed into the corrections which it is necessary to apply to each year of the different series in order to eliminate the sun-spot effect from the curve of pressure.

TABLE III.

Series of years.	Mean variation of pressure.			Mean of three.	Mean correction.
	Madras.	Bombay.	Calcutta.		
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1841-52-63-74-85-96	+.0012	−.0016	−.0040	−.0015	+.002
1842-53-64-75-86	+.0032	+.0038	−.0010	+.0020	−.002
1843-54-65-76-87	+.0018	+.0002	+.0007	+.0009	−.001
1844-55-66-77-88	+.0156	+.0190	+.0132	+.0159	−.016
1845-56-67-78-89	+.0060	.0000	+.0090	+.0050	−.005
1846-57-68-79-90	+.0024	+.0016	−.0020	+.0007	−.001
1847-58-69-80-91	−.0008	+.0030	+.0047	+.0023	−.002
1848-59-70-81-92	−.0090	−.0072	−.0030	−.0064	+.006
1849-60-71-82-93	−.0108	−.0062	−.0065	−.0078	+.008
1850-61-72-83-94	−.0102	−.0078	−.0102	−.0094	+.009
1851-62-73-84-95	−.0004	−.0048	−.0030	−.0027	+.003

Table IV gives the actual annual pressure for each year for the three stations combined, and also the annual pressure when the corrections for the solar-spot cycle, as given in the last column of Table III, have been applied.

TABLE IV.—*Mean pressure of the three stations, Madras, Bombay, and Calcutta, and, also, as corrected for the 11-year cycle.*

Year.	Mean pressure.	Mean pressure corrected.	Year.	Mean pressure.	Mean pressure corrected.	Year.	Mean pressure.	Mean pressure corrected.
	Inches.	*Inches.*		*Inches.*	*Inches.*		*Inches.*	*Inches.*
1841	29.835*	29.807	1860	29.801	29.809	1879	29.802	29.801
1842	.836*	.804	1861	.796	.805	1880	.816	.814
1843	.846*	.815	1862	.793	.796	1881	.819	.825
1844	.839*	.793	1863	.795	.797	1882	.805	.813
1845	.853*	.818	1864	.834	.832	1883	.809	.818
1846	.833†	.817	1865	.826	.825	1884	.827	.830
1847	.816†	.799	1866	.818	.802	1885	.830	.832
1848	.820†	.811	1867	.828	.823	1886	.812	.810
1849	.809†	.802	1868	.831	.830	1887	.811	.810
1850	.822†	.816	1869	.809	.807	1888	.825	.809
1851	.816†	.804	1870	.795	.801	1889	.814	.809
1852	.820†	.813	1871	.806	.814	1890	.809	.808
1853	.811	.809	1872	.803	.812	1891	.828	.826
1854	.810	.809	1873	.809	.812	1892	.794	.800
1855	.825	.809	1874	.812	.814	1893	.816	.824
1856	.811	.806	1875	.806	.804	1894	.805	.814
1857	.810	.809	1876	.809	.808	1895	.818	.821
1858	.817	.815	1877	.854	.838	1896	.814	.816
1859	.818	.824	1878	.817	.812			

*Means of Madras only. †Means of Madras and Bombay only.

Since the annual mean pressure of the whole series is (see Table I) for—

Madras, 29.843 (a);
Bombay, 29.812 (b);
Calcutta, 29.784 (c);

and since $\frac{a+b+c}{3} = 29.813$ (d);

therefore, (a) alone is 0.030″ higher than (d) and $\frac{a+b}{2}$ is 0.015″ higher than (d).

Thus, the Madras means for each year 1841 to 1845 require a correction of —0.030″ to reduce each to the equivalent mean of the three stations, and the combined means of Madras and Bombay for each of the years 1846 to 1852 require a correction of —0.015″. These corrections have been combined with the sun-spot correction in obtaining the third column of Table IV, and the following diagram shows these figures graphically:

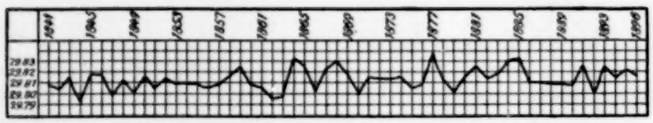

FIG. 1.—Indian pressure curve, corrected for sun-spot variation as derived from 11-year period.

The curve, thus corrected, shows a complicated course, and is obviously composed of numerous small oscillations. At this stage of the investigation it was suggested to me by Mr. Eliot that it would be interesting to treat the Mauritius pressure curve in the same manner. Therefore, the annual pressures for Mauritius were corrected for the 11-year cycle, and the results obtained are shown graphically in the accompanying diagram:

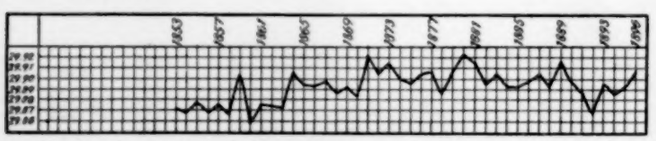

FIG. 2.—Mauritius pressure curve, corrected for sun-spot variation as derived from 11-year period.

For the period 1853 to 1870 there is no information as to the data from which the means for Mauritius were derived, but from 1871 onward the hours of observation are given, and it is thus possible to obtain correct values of barometric pressure. It is obvious that the figures of the earlier years of the series are not comparable with those after 1870, but the latter were sufficient to show that there existed a 9-year period in the pressure variations at Mauritius, and this gave a clew to what appears to be a similar manifestation in the records of mean pressure over India; the course of the Indian pressure curve is, however, generally the reverse of that prevailing at Mauritius. A careful inspection of the Indian curve shows that the crests of the 9-year cycle occur in the years 1841, 1850, 1859, 1868, 1877, 1886, and 1895, and starting with these years the following table has been constructed.

TABLE V.—*Indian pressures arranged in 9-year cycles.*

Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Mean. Variation.	Mean. Correction.
	Inch.		*Inch.*		*Inch.*		*Inch.*		*Inch.*		*Inch.*		*Inch.*		*Inch.*	*Inch.*	*Inch.*
1841	—.006	1850	+.003	1859	+.011	1868	+.017	1877	+.025	1886	—.003	1895	+.008			+.008	—.008
1842	—.009	1851	—.009	1860	—.004	1869	—.006	1878	—.001	1887	—.003	1896	+.003			—.004	+.004
1843	+.002	1852	.000	1861	—.008	1870	—.012	1879	—.012	1888	—.004					—.006	+.006
1844	—.020	1853	—.004	1862	—.017	1871	+.001	1880	+.001	1889	—.004					—.007	+.007
1845	+.005	1854	—.004	1863	—.016	1872	—.001	1881	+.012	1890	—.005					—.002	+.002
1846	+.004	1855	—.004	1864	+.019	1873	—.001	1882	.000	1891	+.013					+.005	—.005
1847	—.014	1856	—.007	1865	+.012	1874	+.001	1883	+.005	1892	—.013					—.003	+.003
1848	—.002	1857	—.004	1866	—.011	1875	—.009	1884	+.017	1893	+.010					.000	.000
1849	—.011	1858	+.002	1867	+.010	1876	—.005	1885	+.019	1894	+.001					+.003	—.003

The mean values in the last column of Table V show a maximum pressure variation in the 1841 series, or the first year of the 9-year cycle; a fall to a minimum in the fourth year of the cycle; then a rise to the sixth year, when marked irregularity occurs; a fall in the seventh year; and, finally, a rise again to the maximum in the first year. Reversing the signs of the variations a correction is obtained which, applied to the different years, removes this cycle from the pressure records. The following table, VI, shows (1) the crude barometric annual averages for the three stations combined and the variation of each annual average from the normal; (2) the mean annual pressure of the three stations combined after being corrected for the influence of the 11-year cycle; (3) the variation of each year from the new normal; (4) the mean annual pressure of the three stations combined after being corrected both for the 11-year and for the 9-year cycles; (5) the variation of each year from the last normal.

TABLE VI.—*Indian pressures corrected for cyclical variations.*

Year.	Crude means.	Variation.	Means corrected for 11-year cycle.	Variation.	Means corrected for 11 and 9 year cycles.	Variation.
	Inches.	*Inch.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*
1841	29.805	—.007	29.807	—.006	29.799	—.014
1842	.806	—.006	.804	—.009	.808	—.005
1843	.816	+.004	.815	+.002	.821	+.008
1844	.809	—.003	.793	—.020	.800	—.013
1845	.823	+.011	.818	+.005	.820	+.006
1846	.818	+.006	.817	+.004	.812	—.001
1847	.801	—.011	.799	—.014	.802	—.011
1848	.805	—.007	.811	—.002	.811	—.002
1849	.794	—.018	.802	—.009	.799	—.014
1850	.807	—.005	.816	+.003	.808	—.005
1851	.801	—.011	.804	—.009	.808	—.005
1852	.811	—.001	.813	.000	.819	+.006
1853	.811	—.001	.809	—.004	.816	+.003
1854	.810	—.002	.809	—.004	.811	—.002
1855	.825	+.013	.809	—.004	.804	—.009
1856	.811	—.001	.806	—.007	.809	—.004
1857	.810	—.002	.809	—.004	.809	—.004
1858	.817	+.005	.815	+.002	.812	—.001
1859	.818	+.006	.824	+.009	.816	+.003
1860	.801	—.011	.809	—.004	.813	.000
1861	.796	—.016	.805	—.008	.811	—.002
1862	.793	—.019	.796	—.017	.803	—.010
1863	.795	—.017	.797	—.016	.799	—.014
1864	.834	+.022	.832	+.019	.827	+.014
1865	.826	+.014	.825	+.012	.828	+.015
1866	.818	+.006	.802	—.011	.802	—.011
1867	.828	+.016	.823	+.010	.820	+.007
1868	.831	+.019	.830	+.017	.822	+.009
1869	.809	—.003	.807	—.006	.811	—.002
1870	.795	—.017	.801	—.012	.807	—.006
1871	.806	—.006	.814	+.001	.821	+.008
1872	.803	—.009	.812	—.001	.814	+.001

TABLE VI.—*Indian pressures corrected for cyclical variations*—Continued.

Year.	Crude means.	Variation.	Means corrected for 11-year cycle.	Variation.	Means corrected for 11 and 9 year cycles.	Variation.
	Inches	*Inch.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*
1873	29.809	−.003	29.812	−.001	29.807	−.006
1874	.812	.000	.814	+.001	.817	+.004
1875	.806	−.006	.804	−.009	.804	−.009
1876	.809	−.003	.808	−.005	.805	−.008
1877	.854	+.042	.838	+.025	.830	+.017
1878	.817	+.005	.812	−.001	.816	+.003
1879	.802	−.010	.801	−.012	.807	−.006
1880	.816	+.004	.814	+.001	.821	+.008
1881	.819	+.007	.825	+.012	.827	+.014
1882	.805	−.007	.813	.000	.808	−.005
1883	.809	−.003	.818	+.005	.821	+.008
1884	.827	+.015	.830	+.017	.830	+.017
1885	.830	+.018	.832	+.019	.829	+.016
1886	.812	.000	.810	−.003	.802	−.011
1887	.811	−.001	.810	−.003	.814	+.001
1888	.825	+.013	.809	−.004	.815	+.002
1889	.814	+.002	.809	−.004	.816	+.003
1890	.809	−.003	.808	−.005	.810	−.003
1891	.826	+.016	.826	+.013	.821	+.008
1892	.794	−.018	.800	−.013	.803	−.010
1893	.816	+.004	.824	+.011	.824	+.011
1894	.805	−.007	.814	+.001	.811	−.002
1895	.818	+.006	.821	+.008	.813	.000
1896	.814	+.002	.816	+.003	.820	+.007
Mean	29.812		29.813		29.813	

Table VI shows that in India the extreme amplitude of the pressure oscillation in the case of the crude means is 0.061, in the case of the means corrected for the 11-year cycle 0.045, and in the case of the means corrected for both cycles 0.031. This diminution in the amplitude of the oscillation with each successive correction, though not a proof of the correctness of these two cycles, is yet a substantial addition to the arguments in their favor. The concluding column of variations exhibits a marked excess of pressure in 1864 and 1865, and again in 1884 and 1885, but there is no similar excess shown in 1844 and 1845, so that as far as can be judged at present the variation is not one which can be anticipated each twenty years, but would appear on each occasion to have been due to local causes, as, for example, heavy snowfall in the Himalayas, etc. Beyond this single coincidence the variations give no indication of the march of any other cycle of change. The departures are small; they exhibit rapid changes of sign, and the only point about them worthy of note appears to be the general tendency to excess during the past thirty years, and a general tendency to deficiency in the first twenty years. In addition there is an instance of decided excess in the year 1877, but this excess, though, as a matter of fact, accompanied with very large meteorological variations in India, also appears to have been an isolated occurrence, probably also attributable to local causes. The year 1877 was a year of maximum positive variation in the 9-year cycle, and the normal excess of pressure was intensified by independent causes.

The investigation, so far as it has proceeded up to this point, shows that the series of combined pressure observations of the three stations, Bombay, Madras, and Calcutta, exhibits two cycles of change, viz, a cycle of eleven years (perhaps agreeing with the changes in the number of spots on the solar surface), and a variation agreeing with a 9-year period. These two sets of variations are shown in Table VII.

TABLE VII.—*Cycles of departures from normal barometric pressure.*

11-year cycle.		9-year cycle.	
	Inch.		*Inch.*
1st year	−.0015	1st year	+.008
2d year	+.0020	2d year	−.004
3d year	+.0009	3d year	−.006
4th year	+.0159	4th year	−.007
5th year	+.0050	5th year	−.002
6th year	+.0007	6th year	+.005
7th year	+.0023	7th year	−.003
8th year	−.0064	8th year	.000
9th year	−.0078	9th year	+.003
10th year	−.0094		
11th year	−.0027		

Finally it has been shown that when the above variations have been applied as corrections to the annual pressure values the amplitude of the pressure oscillation is very materially diminished, and that the residual variations exhibit no further sign of cyclical change during the period under discussion.

The next step in the investigation is to attempt to connect these periodic changes in pressure with the records of weather in India. In the Famine Commission Report, on page 34, there is given a table showing the rainfall at Madras for the years 1800 to 1878, and to this I have added the annual rainfall for the subsequent years up to 1896. The objections to the employment of the records of a single station for the purpose of showing the connection between pressure and rainfall are sufficiently obvious to every one. The following remarks by the late Mr. Pogson, C. I. E., government astronomer at Madras, may, however, be quoted to illustrate the difficulties which must be faced. The year 1877 over India generally was one of disastrously deficient rainfall, yet in Madras "in 1877 a purely cyclonic rainfall in May added 21 inches abnormally to the annual amount, and a similar quantity in November was also chiefly cyclonic. Deducting these amounts the register for the year would have been 24 instead of 66 inches." With this caution the process of connecting the march of the two elements will now be proceeded with. Table VIII gives the table of rainfall mentioned above. The first, fourth, and seventh columns give the years; the second, fifth, and eighth, Wolff's relative number of sun spots; and the third, sixth, and ninth, the annual rainfall at the Madras observatory. Attached to each figure giving the rainfall is a number (1 to 9) which shows the position of the year in the 9-year cycle.

TABLE VIII.—*Wolff's relative numbers for sun-spot frequency and the annual rainfall in inches and tenths at Madras Observatory.*

Year.	Sun-spot frequency.	Rainfall.	Year.	Sun-spot frequency.	Rainfall.	Year.	Sun-spot frequency.	Rainfall.
1800	15.3	? (5)	1833	8.5	37.1 (2)	1866	16.3	51.4 (8)
1801	34.0	? (6)	1834	13.2	39.0 (3)	1867	7.3	24.4 (9)
1802	55.0	? (7)	1835	56.9	41.5 (4)	1868	37.3	41.4 (1)
1803	71.2	66.1 (8)	1836	121.8	44.8 (5)	1869	73.9	32.3 (2)
1804	73.1	31.1 (9)	1837	138.2	49.3 (6)	1870	139.1	74.1 (3)
1805	47.6	31.2 (1)	1838	103.1	52.3 (7)	1871	111.2	56.4 (4)
1806	28.9	61.5 (2)	1839	85.8	53.1 (8)	1872	101.7	73.7 (5)
1807	9.4	14.3 (3)	1840	63.2	58.7 (9)	1873	66.3	51.8 (6)
1808	7.7	? (4)	1841	36.8	58.3 (1)	1874	44.6	62.9 (7)
1809	2.5	? (5)	1842	24.2	36.5 (2)	1875	17.1	37.1 (8)
1810	0.0	? (6)	1843	10.7	50.3 (3)	1876	11.3	21.6 (9)
1811	1.4	39.7 (7)	1844	15.0	65.4 (4)	1877	12.3	66.2 (1)
1812	5.5	? (8)	1845	40.1	38.1 (5)	1878	3.4	28.7 (2)
1813	12.8	45.1 (9)	1846	61.5	79.8 (6)	1879	6.0	54.3 (3)
1814	14.4	32.4 (1)	1847	98.4	81.0 (7)	1880	32.3	61.8 (4)
1815	35.4	56.0 (2)	1848	124.3	54.8 (8)	1881	54.2	44.0 (5)
1816	46.4	41.2 (3)	1849	95.9	39.8 (9)	1882	59.3	50.2 (6)
1817	41.5	63.6 (4)	1850	66.5	36.9 (1)	1883	62.8	60.5 (7)
1818	30.0	76.3 (5)	1851	64.5	64.3 (2)	1884	63.3	78.9 (8)
1819	24.2	36.3 (6)	1852	54.2	72.7 (3)	1885	50.3	47.9 (9)
1820	15.0	70.0 (7)	1853	39.0	35.8 (4)	1886	25.7	47.8 (1)
1821	6.1	47.1 (8)	1854	20.6	43.2 (5)	1887	13.1	70.2 (2)
1822	4.0	59.6 (9)	1855	6.7	32.3 (6)	1888	6.7	62.5 (3)
1823	1.8	26.6 (1)	1856	4.3	47.0 (7)	1889	5.8	43.4 (4)
1824	8.6	33.7 (2)	1857	22.8	53.0 (8)	1890	7.1	28.0 (5)
1825	15.6	56.1 (3)	1858	54.8	48.5 (9)	1891	35.6	30.4 (6)
1826	36.0	60.7 (4)	1859	93.8	55.1 (1)	1892	73.8	42.0 (7)
1827	49.4	88.4 (5)	1860	95.7	27.6 (2)	1893	?	44.0 (8)
1828	62.5	37.9 (6)	1861	77.2	37.2 (3)	1894	?	47.8 (9)
1829	67.3	36.9 (7)	1862	59.1	38.2 (4)	1895	?	47.4 (1)
1830	70.7	32.4 (8)	1863	44.0	54.6 (5)	1896	?	68.7 (2)
1831	47.8	44.4 (9)	1864	46.9	47.2 (6)			
1832	27.5	18.5 (1)	1865	30.5	41.6 (7)			

Taking first the 11-year cycle, the above table shows a general direct agreement between the number of solar spots and the amount of rainfall at Madras. In order to obtain values which can be compared directly with the pressure values of the 11-year cycle given in Table III, the annual rainfall values for each eleven years, beginning with 1808, have been combined, as shown in Table IX.

TABLE IX.—*Annual rainfall at Madras, arranged in 11-year cycles.*

Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Mean rainfall.	Variation from the mean of all cycles.
1808	?	1819	36.3	1830	32.4	1841	58.3	1852	72.7	1863	54.6	1874	62.9	1885	47.9	1896	68.7	54.2	+ 5.4
1809	?	1820	70.0	1831	44.4	1842	36.5	1853	35.8	1864	47.2	1875	37.1	1886	47.8	....	....	45.5	— 3.3
1810	?	1821	47.1	1832	18.5	1843	50.3	1854	43.2	1865	41.6	1876	21.6	1887	70.2	....	....	41.8	— 7.0
1811	39.7	1822	59.6	1833	37.1	1844	65.4	1855	32.3	1866	51.4	1877	66.2	1888	62.5	....	....	51.8	+ 3.0
1812	?	1823	26.6	1834	39.0	1845	38.1	1856	47.0	1867	24.4	1878	28.7	1889	43.4	....	....	35.3	—13.5
1813	45.1	1824	33.7	1835	41.5	1846	79.8	1857	53.0	1868	41.4	1879	54.3	1890	38.0	....	....	47.1	— 1.7
1814	32.4	1825	56.1	1836	44.8	1847	81.0	1858	48.5	1869	32.3	1880	61.8	1891	30.4	....	....	48.4	— 0.4
1815	56.0	1826	60.7	1837	49.3	1848	54.8	1859	55.1	1870	74.1	1881	44.0	1892	42.0	....	....	54.5	+ 5.7
1816	41.2	1827	88.4	1838	52.3	1849	39.8	1860	27.6	1871	56.4	1882	50.2	1893	44.0	....	....	50.0	+ 1.2
1817	63.6	1828	37.9	1839	53.1	1850	36.9	1861	37.2	1872	73.7	1883	60.5	1894	47.8	....	....	51.3	+ 2.5
1818	76.3	1829	36.9	1840	58.7	1851	64.3	1862	38.2	1873	51.8	1884	78.9	1895	47.4	....	....	56.6	+ 7.8

From Tables III and IX the following mean results have been obtained for Madras:

TABLE X.

Calendar years.		Cycle year.	Variations.	
Madras rainfall.	Indian pressure.		Rainfall.	Pressure.
			Inches.	*Inch.*
1808-96	1841-96	First	+ 5.4	—.0015
1809-86	1842-86	Second	— 3.3	+.0020
1810-87	1843-87	Third	— 7.0	+.0009
1811-88	1844-88	Fourth	+ 3.0	+.0159
1812-89	1845-89	Fifth	—13.5	+.0005
1813-90	1846-90	Sixth	— 1.7	+.0007
1814-91	1847-91	Seventh	— 0.4	+.0023
1815-92	1848-92	Eighth	+ 5.7	—.0064
1816-93	1849-93	Ninth	+ 1.2	—.0078
1817-94	1850-94	Tenth	+ 2.5	—.0094
1818-95	1851-95	Eleventh...	+ 7.8	—.0027

This is not a very close agreement, but, as will be seen from the following diagram, Fig. 3, there does exist a rough agreement between the variations of pressure and the variations of rainfall:

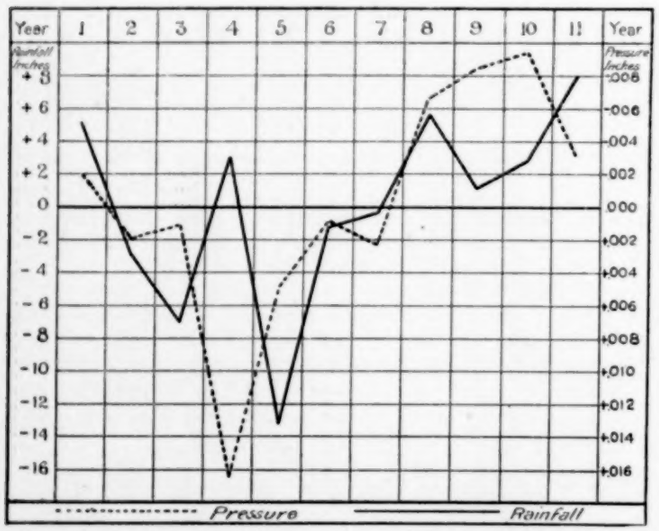

Fig. 3.—Indian pressure and Madras rainfall, 11-year cycle.

Turning next to the 9-year cycle, and treating the Madras rainfall in the same manner, only dividing it into 9-year instead of 11-year periods, the following, Table XI, is constructed:

TABLE XI.

Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.
	Inches		*Inches*		*Inches*		*Inches*		*Inches*		*Inches*		*Inches*
1805...	31.2	1814...	32.4	1823...	26.6	1832...	18.5	1841...	58.3	1850..	36.9		
1806...	61.5	1815...	56.0	1824...	33.7	1833...	37.1	1842...	36.5	1851..	64.3		
1807...	14.3	1816...	41.2	1825...	56.1	1834...	39.0	1843...	50.3	1852..	72.7		
1808...	?	1817...	63.6	1826...	60.7	1835...	41.5	1844...	65.4	1853..	35.8		
1809...	?	1818...	76.3	1827...	88.4	1836...	44.8	1845...	38.1	1854..	43.2		
1810...	?	1819...	36.3	1828...	37.9	1837...	49.3	1846...	79.8	1855..	32.3		
1811...	39.7	1820...	70.0	1829...	36.9	1838...	52.3	1847...	81.0	1856..	47.0		
1812...	?	1821...	47.1	1830...	32.4	1839...	53.1	1848...	54.8	1857..	53.0		
1813...	45.1	1822...	59.6	1831...	44.4	1840...	58.7	1849...	39.8	1858..	48.5		

Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Year.	Rainfall.	Mean.	Variation from mean of all cycles.
	Inches		*Inches*		*Inches*		*Inches*		*Inches*		*Inches*	*Inches*	*Inches*
1859 ...	55.1	1868..	41.4	1877..	66.2	1886..	47.8	1895..	47.4	42.0		47.4	—6.8
1860 ...	27.6	1869..	32.3	1878..	28.7	1887..	70.2	1896..	68.7	47.0		47.0	—1.8
1861 ...	37.2	1870..	74.1	1879..	54.3	1888..	62.5	.....	.....	50.2		50.2	+1.4
1862 ...	38.2	1871..	56.4	1880..	61.8	1889..	43.4	.....	.....	51.9		51.9	+3.1
1863 ...	54.6	1872..	73.7	1881..	44.0	1890..	28.0	.....	.....	54.6		54.6	+5.8
1864 ...	47.2	1873..	51.8	1882..	50.2	1891 ..	30.4	.....	.....	46.1		46.1	—2.7
1865 ...	41.6	1874..	62.9	1883..	60.5	1892..	42.0	.....	.....	53.4		53.4	+4.6
1866 ...	51.4	1875..	37.1	1884..	78.9	1893..	44.0	.....	.....	50.2		50.2	+1.4
1867 ...	24.4	1876.	21.6	1885..	47.9	1894..	47.8	.....	.....	43.8		43.8	—5.0

From Tables V and XI the following results are obtained:

TABLE XII.

Calendar years.		Cycle year.	Variations.	
Madras rainfall.	Indian pressure.		Rainfall.	Pressure.
			Inches.	*Inch.*
1805-95	1841-95	First	—6.8	+.008
1806-96	1842-96	Second	—1.8	—.004
1807-88	1843-88	Third	+1.4	—.006
1808-89	1844-89	Fourth	+3.1	—.007
1809-90	1845-90	Fifth	+5.8	—.002
1810-91	1846-91	Sixth	—2.7	+.005
1811-92	1847-92	Seventh....	+4.6	—.003
1812-93	1848-93	Eighth	+1.4	.000
1813-94	1849-94	Ninth	—5.0	+.003

This table gives the following diagram:

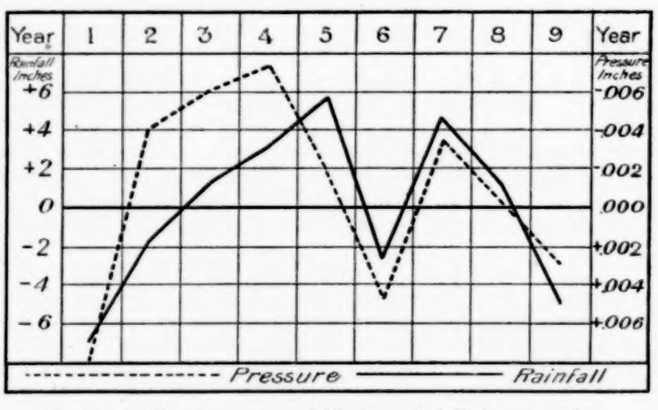

FIG. 4.—Indian pressure and Madras rainfall, 9-year cycle.

The above curves show that in the barometric pressure over India and in the rainfall at Madras there exists an 11-year cycle presumably agreeing with the relative frequency of solar spots, and in addition a 9-year cycle in which the agreement between pressure and rainfall is even more marked and more distinct than in the case of the 11-year cycle.

For the reasons stated above the rainfall discussion has been hitherto confined to the records of Madras observatory,

the rainfall records of the whole of India being available for only a relatively short period. From 1864 onward, however, rainfall returns are obtainable for the whole country, and these returns have been utilized to construct Table XIII.

TABLE XIII.—*Variations of rainfall for all India arranged in* 11-*year cycles.*

Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Mean variation.
	Inches.		*Inches.*		*Inches.*		*Inches.*	*Inches.*
1863	.....	1874	+ 4.6	1885	+ 1.1	1896	— 4.8	+ 0.3
1864	— 5.5	1875	+ 2.4	1886	+ 3.0	.....	.....	0.0
1865	— 0.8	1876	— 4.5	1887	+ 2.6	.....	.....	— 0.9
1866	— 2.1	1877	— 4.3	1888	— 1.5	.....	.....	— 2.6
1867	+ 2.8	1878	+ 6.3	1889	+ 2.5	.....	.....	+ 3.8
1868	— 6.6	1879	+ 1.7	1890	+ 0.7	.....	.....	— 1.4
1869	+ 0.4	1880	— 1.6	1891	— 3.5	.....	.....	— 1.6
1870	+ 1.5	1881	+ 0.1	1892	+ 5.1	.....	.....	+ 2.2
1871	+ 0.9	1882	+ 2.6	1893	+ 9.1	.....	.....	+ 4.2
1872	+ 2.3	1883	— 0.1	1894	+ 6.5	.....	.....	+ 2.9
1873	— 4.5	1884	+ 1.7	1895	— 2.9	.....	.....	— 1.9

The 11-year cycle of Indian pressure (Table III or VII) and of rainfall for all India (Table XIII) are shown in Fig. 5.

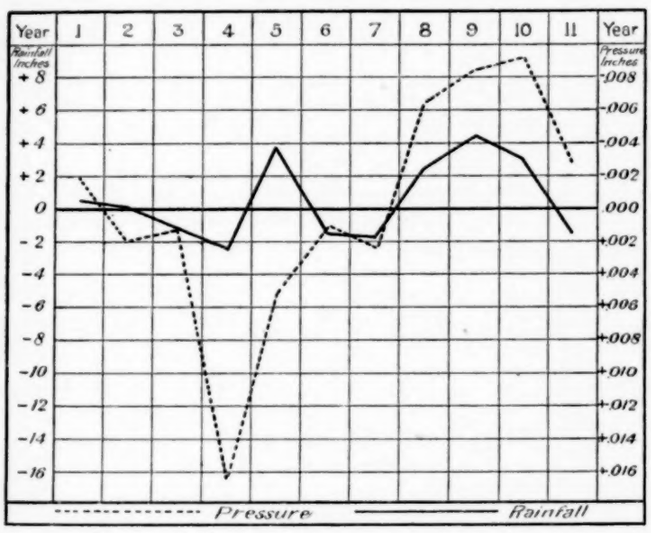

FIG. 5.—Indian pressure and rainfall for all India, 11-year cycle.

The amplitude of the rainfall oscillation for the whole of India is only one-third of that for Madras, but the shape of the curve is the same, and the general agreement between the rainfall and pressure variations is unmistakable.

Dealing next with the same figures, but distributing them over a 9-year cycle, there results Table XIV, as follows:

TABLE XIV.—*Variations of rainfall for all India arranged in* 9-*year cycles.*

Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Year.	Variation.	Mean variation.
	Inches.		*Inches.*		*Inches.*		*Inches.*		*Inches.*	*Inches*
.....	.....	1868	—6.6	1877	—4.3	1886	+3.0	1895	—2.9	—2.7
.....	.....	1869	+0.4	1878	+6.3	1887	+2.6	1896	—4.8	+1.1
.....	.....	1870	+1.5	1879	+1.7	1888	—1.5	.....	.....	+0.6
.....	.....	1871	+0.9	1880	—1.6	1889	+2.5	.....	.....	+0.6
.....	.....	1872	+2.3	1881	+0.1	1890	+0.7	.....	.....	+1.0
1864	—5.5	1873	—4.5	1882	+2.6	1891	—3.5	.....	.....	—2.7
1865	—0.8	1874	+4.6	1883	—0.1	1892	+5.1	.....	.....	+2.2
1866	—2.1	1875	+2.4	1884	+1.7	1893	+9.1	.....	.....	+2.8
1867	+2.8	1876	—4.5	1885	+1.1	1894	+6.5	.....	.....	+1.5

whence, with Table V or VII, the accompanying curves of Fig. 6 are obtained:

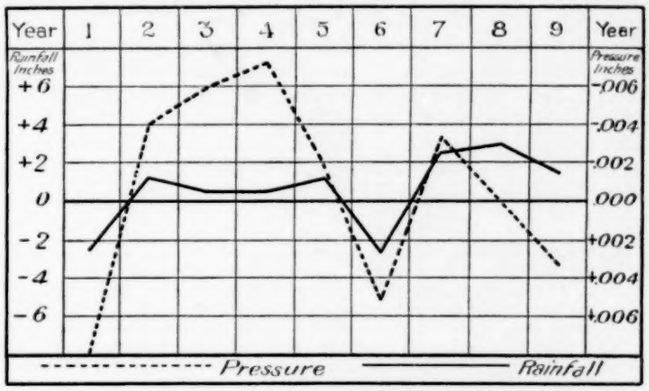

FIG. 6.—Indian pressure and rainfall for all India, 9-year cycle.

It would appear, then, from this investigation, that there are two cycles, both traceable in pressure and rainfall, affecting the weather over the Indian region, the one running through a period of eleven years and the other through a period of nine years. Both appear to be more distinctly traceable in the records of southern India (Madras) than in the records of the whole of India. That these two cycles of change will not account for all the variations of rainfall is sufficiently apparent from the records of the years 1877, 1881, 1887, 1890, 1892, and 1893 in the case of Madras, and 1876, 1883, 1886, 1887, and 1896 in the case of India, as a whole, but they may assist in explaining the numerous variations which are on record, and may afford help in determining the general characteristics of future seasons.

In order to test the practical utility of the system the cyclical variations of rainfall for Madras and for India, for each year from 1864 to 1896, were calculated according to this method, and in the following table are given side by side with the actual variations observed in these years.

TABLE XV.—*Cyclical variations of annual rainfall.*

Year.	Madras.				Whole of India.			
	11-year cycle.	9-year cycle.	Total computed.	Actual observed.	11-year cycle.	9-year cycle.	Total computed.	Actual observed.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1864	— 3.3	— 2.7	— 6.0	— 2.8	0.0	— 2.7	— 2.7	— 5.5
1865	— 7.0	+ 4.6	— 2.4	— 8.4	— 0.9	+ 2.2	+ 1.3	— 0.8
1866	+ 3.0	+ 1.4	+ 4.4	+ 1.4	— 2.6	+ 2.8	+ 0.2	— 2.1
1867	—13.5	— 5.0	—18.5	—25.6	+ 3.8	+ 1.5	+ 5.3	+ 2.8
1868	— 1.7	— 6.8	— 8.5	— 8.6	— 1.4	— 2.7	— 4.1	— 6.6
1869	— 0.4	— 1.8	— 2.2	—17.7	— 1.6	+ 1.1	— 0.5	+ 0.4
1870	+ 5.7	+ 1.4	+ 7.1	+24.1	+ 2.2	+ 0.6	+ 2.8	+ 1.5
1871	+ 1.2	+ 3.1	+ 4.3	+ 6.4	+ 4.2	+ 0.6	+ 5.2	+ 0.9
1872	+ 2.5	+ 5.8	+ 8.3	+23.7	+ 2.9	+ 1.0	+ 3.9	+ 2.3
1873	+ 7.8	— 2.7	+ 5.1	+ 1.8	— 1.9	— 2.7	— 4.6	— 4.5
1874	+ 5.4	+ 4.6	+10.0	+12.9	+ 0.3	+ 2.2	+ 2.5	+ 4.6
1875	— 3.3	+ 1.4	— 1.9	—12.9	0.0	+ 2.8	+ 2.8	+ 2.4
1876	— 7.0	— 5.0	—12.0	—28.4	— 0.9	+ 1.5	+ 0.6	— 4.5
1877	+ 3.0	— 6.8	— 3.8	+16.2	— 2.6	— 2.7	— 5.3	— 4.3
1878	—13.5	— 1.8	—15.3	—22.3	+ 3.8	+ 1.1	+ 4.9	+ 6.3
1879	— 1.7	+ 1.4	— 0.3	+ 4.3	— 1.4	+ 0.6	— 0.8	+ 1.7
1880	— 0.4	+ 3.1	+ 2.7	+11.8	— 1.6	+ 0.6	— 1.0	— 1.6
1881	+ 5.7	+ 5.8	+11.5	— 6.0	+ 2.2	+ 1.0	+ 3.2	+ 0.1
1882	+ 1.2	— 2.7	— 1.5	+ 0.2	+ 4.2	— 2.7	+ 1.5	+ 2.6
1883	+ 2.5	+ 4.6	+ 7.1	+10.5	+ 2.9	+ 2.2	+ 5.1	— 0.1
1884	+ 7.8	+ 1.4	+ 9.2	+28.9	— 1.9	+ 2.8	+ 0.9	+ 1.7
1885	+ 5.4	— 5.0	+ 0.4	— 2.1	+ 0.3	+ 1.5	+ 1.8	+ 1.1
1886	— 3.3	— 6.8	—10.1	— 2.2	0.0	— 2.7	— 2.7	+ 3.0
1887	— 7.0	— 1.8	— 8.8	+20.2	— 0.9	+ 1.1	+ 0.2	+ 2.6
1888	+ 3.0	+ 1.4	+ 4.4	+12.5	— 2.6	+ 0.6	— 2.0	— 1.5
1889	—13.5	+ 3.1	—10.4	— 6.6	+ 3.8	+ 0.6	+ 4.4	+ 2.5
1890	— 1.7	+ 5.8	+ 4.1	—22.2	— 1.4	+ 1.0	— 0.4	+ 0.7
1891	— 0.4	— 2.7	— 3.1	—19.6	— 1.6	— 2.7	— 4.3	— 3.5
1892	+ 5.7	+ 4.6	+10.3	— 8.0	+ 2.2	+ 2.2	+ 4.4	+ 5.1
1893	+ 1.2	+ 1.4	+ 2.6	— 6.0	+ 4.2	+ 2.8	+ 7.0	+ 9.1
1894	+ 2.5	— 5.0	— 2.5	— 2.2	+ 2.9	+ 1.5	+ 4.4	+ 6.5
1895	+ 7.8	— 6.8	— 1.0	— 2.6	— 1.9	— 2.7	— 4.6	— 2.9
1896	+ 5.4	— 1.8	+ 3.6	+18.7	+ 0.3	+ 1.1	+ 1.4	— 4.8

That the method of the two cycles would have given approximately correct rainfall variations in the majority of years is obvious, and that the calculated variations (more particularly in the case of Madras alone) should be smaller than the actual variations is not surprising, but the actual and calculated values in some years are so very divergent that it must be reluctantly conceded that it is impossible by this method "to determine beforehand with any certainty the probable amount of rain in any season, such as would admit of timely precautions being taken against impending drought."

[NOTE.—In publishing this important paper by Mr. Dallas promptly, without incurring the great delay that would be necessitated by submitting the proof sheets to him, several matters have been noticed by the Editor which, although unimportant to the general trend of the argument, may possibly be worth repeating as helpful to the reader.

The word "variations" is used by Mr. Dallas always in the same sense as the word "departures" is used by other writers, viz, the observed value minus the computed value, so that a plus variation is also a plus departure.

The adoption of a regular 11-year cycle, instead of the somewhat irregular sun-spot numbers, which are given in Table VIII (inasmuch as the 11-year and the sun-spot cycles depart widely from each other), seems to show that the 11-year period has no direct connection with the sun spots, and it should, therefore, not be spoken of as a sun-spot period, but simply an 11-year cycle.

The pressures given in Table I for three different series of years should, strictly speaking, be reduced to a common system by adopting the years 1853–1896 as the basis. The mean pressures for these forty-four years are: Madras, 29.844; Bombay, 29.813; Calcutta, 29.784; the mean of all three is 29.814. Adopting this latter figure as the base, we reduce each of the three stations to a common standard by applying the corrections, —0.030, + 0.001, + 0.030. Fortunately these corrections are the same as those used by the author in preparing Table IV and Fig. 1.

With regard to the annual pressures for Mauritius, Mr. Dallas states that they were corrected for the 11-year cycle in order to obtain the curve of Fig. 2. We infer that the corrections were specially computed by him from the Mauritius observations, and that he does not mean to say that he corrected the latter by using the means for India given in Table III.

No reason is given for omitting from Tables IX and XI the earliest years, as given in Table VIII.

In Tables X and XII the author has compared together the Madras rainfall and the Indian pressure, but for quite different groups of years. If the comparison had been for a uniform system of stations and of years, the results might have been more harmonious. It is difficult to separate the influence of this discrepancy as to locality and time from the influence of the general want of physical connection between the rainfall and the pressure.

In Tables XIII, XIV, and XV the figures given in the manuscript for the variations of rainfall for all India show some slight discrepancies, viz: XIII, 1886, +3.0; 1887, +2.4; 1889, +2.5; XIV, 1886, +3.2; 1887, +2.4; 1889, +2.4; XV, 1886, +3.2; 1887, +2.6; 1889, +2.4. These discrepancies the Editor has removed, so that the three tables may be harmonious.

With regard to the variations of rainfall at Madras, as given in Table XV, the reader will notice that the figures of column 5 may be reproduced by assuming the normal for Madras at 50.0 inches and computing from this the departures of the individual years given in Table VIII. Two small discrepancies will be found, viz, the variation for 1878 should be —21.3, and for 1890, —22.0, instead of —22.3 and —22.2, respectively, as published in Table XV.—ED.]

RECENT PUBLICATIONS.

By W. F. R. PHILLIPS, in charge of Library, Weather Bureau.

Austria-Hungary—Veröffendtlichungen d. Hydrographisches Amtes der K. u. k. Kriegs-Marine.
Gruppe II. Jahrbuch der meteorologischen u. erdmagnet. Beobachtungen, neue Folge, Band 1, 1896. 4to. P. 272.
Gruppe III. Relativen Schwerebestimmungen durch Pendelbeobachtungen, 1 Heft, Beobachtungen in den Jahren 1893–1896 während der Reisen S. M. Schiffe, Tasana, Donan, Aurora, u. Meramar. 4to. P. 76.
Gruppe IV. Erdmagnetische Reise-Beobachtungen. 1 Heft. Erdmagnet. Beobach. Ausgeführt Während der Reise S. M. Schiffes, Aurora 1895–96. Süd und ostasiatische Küsten. 4to. P. 32.
Gruppe V. 1 Heft. Geschichtliche Darstellung der Entwicklung des K. u. k. Hydrographischen Amtes, von Anton Gareis. 1897. 4to. P. 25.

France—Département des Bouches-du-Rhône. Commission de Météorologie. Bulletin Annuel, 1891 to 1895. 4to. Marseille 1891-96.

Germany—Elsass-Lothringen. Deutsches Meteorologisches Jahrbuch, 1895. 4to. P. VIII, 55. Strassburg, 1897.
Harzer, Dr. Paul. Ueber geographische Ortsbestimmungen ohne astronomische Instrumente. Elementare Darstellung. Dr. A. Petermann's Mittheilungen, Ergänzungsheft. No. 123. 4to. P. 127. Gotha, 1897.

India—Report on the meteorology of Ceylon for 1896. By F. H. Grinlington, Surveyor General for Colombo. Folio. P. 35. 3 charts. 1896.

Mauritius—Royal Alfred Observatory. Meteorological results for 1896. Folio. P. 27. Port Louis, 1896.

Mexico—Anuario del Observatorio Astronómico Nacional de Tacubaya para el año de 1898. Formado bajo la direccion del Ingeniero Angel Anguiana. Año. XVIII. 16mo. P. 460. Mexico, 1897.

Naturforschenden Gesellschaft in Emden. Jahresbericht pro 1895–1896. 8vo. P. 39. Emden, 1897.

Netherlands. Annuaire Météorologique pour 1895. Publié par l'Institut Royal Météorologique des Pays-Bas. Quarante-septième année. 4to. P. XXX. 370. Utrecht, 1897.
Observations made at the Magnetical and Meteorological Observatory at Batavia. Published by order of the Government of Netherthelands-India. Van der Stok. Vol. XIX. Folio. P. 214. Batavia, 1896.
Regenwaarnemingen in Nederlandisch-Indie. Achttiende Jaargang, 1896. Uitgegeven ap last der Nederlandisch-Indische Regeering. Van der Stok. 4to. p. 468. [Similar volumes for the years 1893 and 1894.]

Nipher, Francis E. A method of measuring the pressure at any point on a structure, due to wind blowing against that structure. Trans. Acad. of Sciences of St. Louis. Vol. VIII. No. I. 8vo. P. 24. Plates 2. 1897.

Physikalische Gesellschaft zu Berlin. Die fortschritte der Physik im Jahre 1896. Zweite abtheilung. Redigirt von Richard Börnstein. 8vo. P. XLIX. 820. Braunschweig, 1897.

Physikalische Verein zu Frankfurt-am-Main. Jahresbericht, 1895–1896. 8vo. P. 99. Frankfurt, 1897.

Rotch, A. Lawrence. Meteorological investigations in the free air, at the Blue Hill observatory. Reprinted from the Journal of the Association of Engineering Societies, Vol. XIX, No. 1, July, 1897. 8vo. P. 7. Boston, 1897.
Studies of the upper air. Reprinted from the Boston Commonwealth, April, 1895. 8vo. P. 8. Boston, 1895.

Royal Cornwall Polytechnic Society. (Established 1833.) Sixty-Fourth Annual Report, 1896. 8vo. P. 142. Falmouth, 1896.

Russia—Meteorologische Beobachtungen angestellt in Dorpat im Jahre 1895. Dreissigster Jahrgang. VI Band. 5 Heft. 8vo. Pp. 293–357. Dorpat-Jurjev, 1897.

Livonia—Kaiserliche Livlandische gemeinnützige u. ökonomische Sozietät. Bericht über die Ergebnisse der Beobachtungen an den Regenstationen für das Jahr 1896. Dorpat, 1897. 4to. P. 17.

Spain—San Fernando Observatorio de Marina. Anales Seccion 2.a Observaciones meteorologicas y magneticas año, 1865. Fol. P. 155. San Fernando, 1896.

Sweden—Observations Météorologiques Suédoises publiées par l'Académie Royale des Sciences de Suède, exécutées et rédigées sous la direction de l'Institut Central de Météorologie. Vol, 34. 2ième Série. Vol. 20. 4to. P. 153.

Switzerland. Sternwarte des Edg. Polytechnikums. Beobachtungen der Sonnenoberfläche in den Jahren 1887–1889. A. Wolfer. Band I. P. XXVII, 41. Zürich, 1897.

Symons, G. J.—Index to Symon's Monthly Meteorological Magazine. Vols. I-XXX, (1866–1895). 8vo. P. IV, 84. London, 1897.

Smithsonian Institution. The History of its First Half Century. Edited by George Brown Goode. 4to. P. XII, 856. Washington, 1897.

Texas Academy of Science. Transactions, 1897. 8vo. P. 107. Austin, 1897.

U. S. Department of Agriculture. Weather Bureau. Report of the Chief of the Weather Bureau, 1896-97. By Willis L. Moore. 8vo. P. 28. Washington, 1897.
Bulletin E, Floods of the Mississippi River. By Park Morrill. 4to. P. 79. Charts 58. Washington, 1897.

U. S. Treasury Department. Report of the Superintendent of the U. S. Coast and Geodetic Survey, showing the progress of the work during the fiscal year ending with June, 1896. 4to. P. XXIII, 722. Washington, 1897.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in ad-

vance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW during 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for December, 1897.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Arteaga (Coahuila)	.....	.....	83.3	29.7	59.5	.....	0.00	.....	.....
Barousse (Coahuila)	5,414	.....	77.7	32.0	58.3	.....	0.00	.....	.....
Colima (Sem.)	1,656	.....	.....	.....	75.7	.....	.....	.....	.....
Durango	6,241	24.04	78.8	39.2	54.9	51	0.28	sw.	sw.
Leon	5,934	24.32	75.4	27.7	57.9	51	T.	se.	wsw.
Linares (Nuevo Leon)	1,188	29.00	83.3	35.6	56.1	70	0.37	.....	.....
Magdalena (Sonora)	4,948	.....	.....	.....	55.4	.....	0.03	ne.	n.
Merida (Yucatan)	50	30.01	94.5	54.5	74.3	72	0.23	ne.	n.
Mexico (Obs. Cent.)	7,472	23.10	70.7	35.6	55.8	58	0.03	e.	ne.
Monterey	1,626	28.41	84.2	37.2	55.8	63	0.23	e.	ne.
Morelia (Seminario)	6,401	24.40	76.3	39.2	59.2	63	0.12	sw.	w.
Oaxaca	5,164	25.11	82.4	40.1	74.3	60	0.49	w.	ne.
Parros (Coahuila)	3,986	.....	74.8	42.8	59.2	.....	0.71	.....	.....
Puebla (Col. Cat.)	7,112	23.52	75.6	30.7	58.8	52	0.08	ne.	.....
Rosario (Sinaloa)	.....	.....	93.0	21.0	60.3	.....	0.04	sw.	s.
Saltillo (Col. S. Juan)	5,399	24.91	77.2	32.0	55.6	62	T.	s.	n.
San Luis Potosi	6,202	24.30	73.4	35.1	56.8	57	0.06	ne.	w.
Silao (Guanajuato)	6,063	24.32	72.0	39.0	60.8	58	T.	w., sw.	w.
Torreon (Coahuila)	3,720	.....	78.4	37.4	60.8	.....	0.00	.....	.....
Trejo (Guanajuato)	.....	.....	63.5	.....	.....	.....	0.00	w.	.....
Tuxtla (Gutierrez)	1,864	28.06	91.4	51.8	72.9	71	0.00	n.	sse.
Zapotlan (Seminario)	5,078	.....	78.3	44.2	55.2	55	0.00	sse.	sw.

THE ELECTRIC STORMS OF CALIFORNIA.

By J. A. BARWICK, Observer Weather Bureau (dated Sacramento, December 18, 1897).

The electric storms of California are not local to any one portion of the State over another; thunderstorms are observed as occurring on the same day over 800 miles apart, viz, at Picacho, San Diego County, in the southeastern portion of the State, and at Yreka, Siskiyou County, in the northern portion of the State.

During the thunderstorm of August 19, 1896, electric displays were observed in the following counties, beginning in the north and going south, viz, Siskiyou, Modoc, Lassen, Tehama, Sonoma, Alameda, Santa Clara, Mono, San Bernardino, and San Diego counties. Siskiyou and San Diego counties are nearly 800 miles apart.

The greater number of thunderstorms in summer (June, July, and August) are confined mostly to the counties of the Coast Range and the Sierra Nevada range of mountains. Scarcely a day passes in summer but what the tops of thunderhead clouds, such as cumulo-stratus and cumulo-nimbus, may be observed from Sacramento over the Sierra Nevada range of mountains, especially in the northeastern and eastern portions of the horizon. The greater number of these storms are noted in July and August, during and at the closing of a hot spell in the Sacramento and San Joaquin valleys. As the hot and moist-laden air rises it strikes the upper southwesterly current of air and is wafted over the Sierra Nevada Mountains, where the moisture is rapidly condensed, forming these thunder-head clouds. It is among such clouds as these that so much sheet lightning is observed and reported by observers in the foothill and valley towns.

The greater number of these storms are reported as occurring during the months of May, June, July, August, and September; the hotter the weather in summer the greater are the number of such storms observed and reported. The records for 1896 and 1897 show a greater number recorded. Possibly this is due partly to an increased number of observers and to more accurate records of those storms than during previous years, when a much smaller number was reported.

The tabulated data herewith gives a record of all electric storms reported by the voluntary observers throughout the State from September, 1891, to October, 1897, inclusive.

Total number of thunderstorms recorded as having occurred in the State of California from September, 1891, to October, 1897.

Year.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	Total.	Monthly averages.
January	.....	0	1	6	5	7	6	25	4
February	.....	2	0	0	1	4	8	15	3
March	.....	9	4	2	3	3	7	28	5
April	.....	3	2	4	5	9	5	28	5
May	.....	4	7	6	4	13	10	44	7
June	.....	6	0	9	5	11	15	46	8
July	.....	8	8	12	3	25	4	60	10
August	.....	2	0	15	6	18	17	58	10
September	2	8	6	2	7	12	14	51	7
October	1	9	0	1	10	4	5	30	4
November	0	7	3	1	0	0	.....	11	2
December	2	1	6	4	3	1	.....	17	3
Total	*5	59	37	62	52	107	†91	413	88

NOTE.—Total and average for September and October are for seven years. *For four months. †For ten months.

It is true that during cool summers there are much fewer electrical displays than during hot summers with long-continued spells of excessive heat. Had I the time I should be pleased to prepare a chart showing the counties where electric displays were recorded from 1891 to 1897. By such means the points in the State where the greatest number of electric displays are observed would be plainly indicated. No doubt, if our summers in California were as wet and stormy as in the States east of the Rocky Mountains, our record of magnificent electric displays would be equal to those of the East.

In March, 1881, when I took charge of this station, it was reported to me by numerous "oldest inhabitants" that there was no such thing in this State as thunder and lightning. As the same idea had been reported to people in the East, inquiry was made of this office asking if such were the fact. Our records for this station were searched and an article prepared and published in the Monthly Bulletin of the California Weather Service for June, 1893, covering the years from July 1, 1877, to May 17, 1893.

The following are descriptions by the voluntary observers of electric storms of severity that were recorded by them:

September 5, 1891.—Telephones burned out at Pleasanton and Livermore, Alameda County.

June 8, 1892.—Oleta, Amador County, lightning struck a pine tree on the roadside near the village, killing 18 sheep out of a passing band.

September 25, 1892.—Milton, Calaveras County, lightning quite vivid, and was a remarkable and unusual display for this part of the country. Nevada City, Nevada County, September 25, 1892, was the severest and longest ever known to the oldest resident of this section. San Jose, Santa Clara County, the storm of the 25th was the greatest electrical display ever seen by the residents of this city; many young people saw more lightning and heard more thunder than they had ever before observed. Willows, Glenn County, on the evening of the 25th the electric storm in the Sierra Nevada Mountains showed lightning of every kind, visible from this town, from northeast along the entire horizon to the southeast; sometimes for half an hour the lightning was continuous; only a few clouds were visible from this point.

May 12, 1893.—A very sharp thunderstorm passed over Pasadena, Los Angeles County, giving a dozen blinding flashes of lightning; one flash struck the earth within 1,000 feet of the observer and was followed by a tremendous crash. Colegrove, Los Angeles County, on the 12th lightning vivid, several wavy streaks observed in the distant east, which extended horizontally through the clouds at least 15 to 20 miles in length.

May 17, 1893.—Anderson, Shasta County, this storm was the worst that has ever passed over this section; the center appeared to be over Redding, doing some damage by striking the Presbyterian church spire and tearing it away; some two hundred yards away from the church it struck the tree on which the Ruggles brothers were hanged. There were three movements of clouds, one passing along the Coast Range northeast, one along the foothills from the east to the northwest, and one in the center moving northward, all forming over the town of Redding; balls of electricity dropped off the electric wires. It was a grand display, but without much damage.

November 24, 1893.—Heavy thunderstorm at Hydesville, Humboldt County, the lightning struck a tree about 5 miles east of this town and set it on fire.

December 27, 1893.—Severe thunderstorm passed over Pasadena, Los Angeles County, one bolt of lightning striking a stable and destroying it, along with 75 tons of hay.

July 9, 1894.—At Gardnerville, Alpine County, lightning struck a barn, killing one horse and stunning several persons, and the building was set on fire by the lightning.

In his review for July, 1896, Mr. Barwick says:

There were heavy thunder and lightning storms over all the mountain regions of the State, with numerous cloudbursts, and, singular to relate, these cloudbursts appear to have occurred on the day of the occurrence of the maximum temperature over the greater portion of the interior of the State, namely, on the 9th of July.

Thunder and lightning were reported from several places along the coast, which are rather unusual occurrences. Generally speaking the cloudbursts and thunder and lightning storms occurred during the prevalence of the long and severe hot spell of July, from the 1st to the 25th. From all accounts this was the most disastrous hot spell to the interior valleys of California since the unprecedented hot wave of June and July, 1859, when horses died in great numbers, and even birds and wild animals succumbed to the fierce rays of the sun, and several persons were reported to have died from the effects of the hot wave.

NOTES BY THE EDITOR.

MECHANICAL DETERMINATION OF RESULTANT WIND.

At the December meeting of the Meteorological Society of France, M. L. Besson exhibited an instrument that gives, mechanically, the mean direction and force of the wind, and thus dispenses with the calculations that are necessary in the application of Lambert's method.

This instrument is composed essentially of a vertical wheel, moving easily around its axis, and having near its circumference small equidistant projecting horizontal pins or rods to the number, for example, of sixteen, corresponding to the sixteen principal directions of the wind. If we hang on each of these pins a weight proportional to the movement of the corresponding wind, the wheel will take a certain position of equilibrium, such that the lowest point of the wheel indicates exactly the resultant direction of the wind movement. The apparatus can be made more complete by adding a balanced alidade, which is itself provided at one end with a small pin similar to those of the principal wheel. When the direction of the resultant has been found we set the alidade to the opposite direction, and suspend from it certain weights, until we obtain neutral equilibrium. By giving to the alidade a convenient length we can thus, directly, measure the relative value of the resultant, that is to say, the degree of variability of the wind during the period under consideration.* The model actually presented to the society shows the simplest form that can be given to this instrument. It is intended for the determination of the mean direction of the wind during any one day, from hourly or trihourly observations. The weights that are employed are counters of equal mass, pierced through their centers; each of these represents one observation. One may agree to call the wind variable if twelve counters suspended on the pin opposite to the resultant suffice to bring the system into neutral equilibrium.

These mechanical devices in the hands of skillful manipulators will scarcely do their work more quickly, and will rarely do it as accurately as can be done by the skillful computor. The simple form used by the Weather Bureau for the computation of resultant winds, when used in connection with Crelle's multiplication table, is probably better than the mechanical device, and yet there are many who would prefer the latter as avoiding the ordinary errors of computation.

There are many other mechanical devices that may be advantageously introduced into meteorological computations. Professor Mascart, who presided at the meeting of the Meteorological Society, suggested that the same apparatus could also be applied to the solution of questions regarding the composition of colors, thereby replacing the whirling disk of Sir Isaac Newton, and the color-triangle of Lord Rayleigh. In fact, the apparatus can be used for showing quickly the resultant of any complex system of forces, provided they all act at one point of application and do not introduce moments of rotation.

The apparatus of Besson, as above described, can apparently be simplified by omitting the alidade and substituting the following construction. The resultant direction is usually desired to within two or three degrees. In order to secure this degree of accuracy we divide the circumference into 128 equal parts, each representing $2\frac{13}{16}$ degrees, and insert corresponding pins, giving each a letter or number from *north* around the entire circle consecutively. On a wheel 20 inches in diameter each of the 128 pins would be about half an inch from its neighbor. When the pins for the sixteen wind directions have been properly weighted and the wheel has come to its position of equilibrium, which should be tested by several successive oscillations to the right and left, and when one has decided which of the pins is the lowest when the wheel has come to a rest, and which, therefore, indicates the resultant wind direction, he is to select the pin diametrically opposite to this resultant, and load it with additional weights until the wheel is neutral in all positions. But even in this simplified form it may be doubted whether the mechanism is any better than properly arranged forms of numerical computation.

THE METEOROLOGICAL STATIONS OF HARVARD UNIVERSITY.

The annual report for October, 1896, to September, 1897, inclusive, of Prof. Edward C. Pickering, as director of the astronomical observatory of Harvard College, shows his high appreciation of the importance of meteorology in connection with astronomy. The atmosphere by its refraction alters the apparent position of the stars; by the irregular refractions, due to the want of perfect homogeneity, the atmosphere introduces the blurred images and the rapid oscillations that prevent perfect steadiness of vision and cause the so-called "poor seeing;" by its dispersive power the atmosphere, acting like a prism, gives confusing colors and distorted outlines to the images of the stars and planets; by its general absorption the atmosphere renders the faintest stars invisible, and even the brightest stars may become invisible near the horizon; by its selective absorption the atmosphere introduces its own lines into the spectrum of the sunlight. The search after good seeing and the study of the brightness, or the variations in brightness of the variable stars, have led Professor Pickering to investigate the atmosphere of the Southern Hemisphere, in which work he was encouraged by the late Uriah Boyden, who left a large fund for astronomical research. An astronomical station is maintained at the city of Arequipa, Peru, and in connection with it the following "Boyden" meteorological stations:

Mejia (elevation 55 feet); La Joya (4,141); Arequipa (8,050); Alto de los Huesos (13,400); Mont Blanc station on El Misti (15,700); El Misti (19,200), and Cuzco (11,378).*

* The variability of the wind is, strictly speaking, shown only by the relative number of the times that each direction of the wind occurs. If the wind has blown from all possible directions, then the resultant velocity is generally much smaller than when the wind blows steadily from one direction, therefore, the strength of the resultant is, in a rough way, indicative of the variability or the degree to which opposing winds have neutralized each other.—C. A.

* An article by Mr. R. DeC. Ward in Science for January 21, 1898, adds a new station, Echarati, 130 miles north of Cuzco, latitude, 13° 31′ S.; longitude, 74° 24′ W.; elevation, 11,378 feet. The elevations of the instruments given in the above text have been corrected to agree with this recent article by Mr. Ward, to which we must refer the reader for many interesting details.

Continuous observations were obtained at the summit of El Misti by means of the new meteorograph.

By an arrangement with the Park Commissioners for the city of Boston the upper portion of Blue Hill was purchased in 1875 and transferred to the care of the Harvard observatory. This hill is about eight miles south of the observatory, and upon it was placed one of the transit circle meridian marks when the observatory was first erected by W. C. Bond in 1838. Thus it happens that the Blue Hill Observatory now comes under the general supervision of Professor Pickering and the authorities of Harvard University, but, of course, without interfering with the independence of this coordinated institution. Professor Pickering's annual report states that a description of the method of exploration of the upper air with kites, with a discussion of the observations, from 1894 until the beginning of 1897, forms an appendix to the observations of 1896 in Vol. XLII, Part I of the "Annals," now in course of publication. He also adds that the observations of the New England Weather Service will not hereafter appear in the annals of the observatory, but will be "published in the Monthly Weather Review," by which latter name he, undoubtedly, intends "the Monthly report of the New England Section of the Climate and Crop Service of the Weather Bureau." These monthly reports from the various sections contain a great deal of information that is not given in the MONTHLY WEATHER REVIEW published at Washington, which latter can at best give but a brief summary of the details given in these reports.

IMPORTANCE OF THE MONTHLY REPORTS OF THE SECTIONS.

These monthly section reports are, we fear, not always appreciated as they should be, as a permanent detailed record of our climatic data. The set of twelve numbers for each year should be preserved and bound by each recipient, or if more convenient, presented to some library where it will be properly cared for and generally accessible to the public. If sets of these could be presented to the prominent Government weather bureaus throughout the world, and personally to those who are known to be active students of climatology, they would, undoubtedly, contribute to remove much of the ignorance that prevails with regard to the climate of America.

METEOROLOGY IN THE UNITED STATES GEOLOGICAL SURVEY.

There are, of course, many matters that must be attended to in the prosecution of the duties imposed upon the Director of the Geological Survey that bear closely upon meteorology and the work of the Weather Bureau. There is apparently no duplication of work in these two bureaus, but each must carry on certain parallel lines of work in order to accomplish the object it has in view. On looking over the eighteenth annual report of the director of the survey, for the fiscal year ending June, 1897, we note the following items that will interest the students of American climatology. First of all we must mention the magnificent topographical survey and the published maps without which one can not understand the climatology of any portion of the country, so much does the climate of any spot depend upon its elevation, its aspect, and its drainage. Precise levelings, in the geodetic sense of the word, are made by the Coast and Geodetic Survey, but the detailed plane-table survey belongs to the topographic division of the Geological Survey.

The altitude of the cistern of the barometer is believed to be now known for every Weather Bureau station, by the help of the accurate levels made first for railroad and canal work and now by the Geodetic and the Topographic Surveys. It has sometimes been erroneously assumed by European meteorologists that the altitudes used in reducing American stations to sea level were necessarily approximate barometric determinations.

Very few have realized the great value of the accurate levelings that have extended over this whole country in connection with the building of railroads and canals. Extensive collections of these levels were first made by Mr. Ellet; these were further supplemented by other data collected by Mr. William Nicholson for the Smithsonian Institution, which were intended as a contribution toward a hypsometric map of North America. Such a map was first prepared by Mr. Schott for the statistical atlas, published in 1874 in connection with the Census of 1870. This data was still further increased by the work done by myself in preparing the revised altitudes of Signal Service stations adopted in November, 1872, which was also the first extensive effort to adjust the discrepancies along the various lines. The work has since then been greatly extended by Mr. Gannett, on behalf of the Hayden Survey and the United States Geological Survey.

The geologist often fills in many details by the help of the barometer, using the differential methods. The method perfected by Gilbert and Gannett for this barometric hypsometry constitutes another point of contact between the work of the Weather Bureau and that of the Geological Survey.

By its study of the glacial drift the Survey contributes to our knowledge of the distribution of ice and snow as the principal climatic feature in one of the ancient eras. In this connection also the study of the water stored up in the soil, as collected from artesian wells, mineral springs, and ordinary wells has not only a direct bearing upon present agricultural possibilities, but upon past climates.

It is found that great agricultural differences arise from varying degrees of porosity of the several classes of glacial and glacial-river deposits. This leads to the conviction that a classification of soils, based upon their relation to the glacial agencies by which they were formed, would be of fundamental importance to agriculture.

Observations have been made by the Survey in a very deep well which is being drilled near Pittsburg and which will probably extend more than a mile into the earth. If such a well can be continued downward far enough to entirely escape the temperature conditions that prevail among the various sedimentary strata near the surface of the globe, it must, eventually, give us much information that will elucidate the evolution of our globe and our atmosphere.

In the division of hydrography, under Mr. F. H. Newell, measurements or computations of the water discharge of the rivers have been made for about 170 rivers, fairly well distributed over the Atlantic and Pacific States and in the interior. In this connection measurements of seepage and measurements of rainfall have, of course, also been made. As the windmill is extensively used in raising water for irrigation, therefore special studies have been made upon the employment and efficiency of windmills. These memoirs, by Barbour, Murphy, and Hood, constitute a first installment of the important work that was commended to the attention of all concerned by the Editor of the MONTHLY WEATHER REVIEW in April, 1895, Vol. XXIII, page 131, in an article on "The Efficiency of Windmills and Farmers' Tools." The measurements of rainfall, evaporation, seepage, and river discharge constitute the fundamental data by means of which we get an approximate idea of the quantity of water that passes back into the atmosphere from the surface of the continent, as distinguished from that which comes from the ocean and from frozen lakes, rivers, and snow beds. These data have also an important bearing on the problems that are involved in every effort to predict the floods and low waters of our rivers, a work that is especially committed to the Weather Bureau.

The most recent addition to the work of the Survey has

been the mapping and description, and probably, eventually, the care of the national forest reserves. This opens up a new branch of work in which temperature, rainfall, wind, and other meteorological conditions must be considered.

On page 116 of Mr. Walcott's report as director he states:

> The preparation of a physical atlas of the United States, upon which much work had been done in former years, was continued. Climatic maps were prepared, which include maps of mean monthly temperature, of annual pressure, cloudiness and snowfall, monthly and annual maps of relative humidity, and maps showing the range in temperature between the hottest and coldest months; in all 28 maps. Besides these diagrams have been prepared of the slopes of the rivers of the United States.

As nearly all the climatic data for the United States is preserved in the archives of the Weather Bureau, it would seem that the climatic maps prepared by the Geological Survey must be essentially the same as those prepared by the Weather Bureau. There are, undoubtedly, frequent inquiries for a physical atlas and, so far as meteorological elements are concerned, the Weather Bureau has furnished its data freely to all inquirers and has published that for which there seemed to be the greatest demand. Plans for a national physical atlas were submitted by Prof. Joseph Henry in 1847 for publication by the Smithsonian Institution. An atlas of this character was published by Gen. Francis A. Walker, in connection with the census of 1870, to which, at the suggestion of the present writer, the Weather Bureau contributed four meteorological charts. When Mr. Gannett was assigned to duty in the Census Bureau as geographer, in addition to his duties as Topographer in the Geological Survey, many climatic charts were prepared by him for the publications of the census of 1880, and a revision of these was begun for the eleventh census of 1890. It is evident that by the proper cooperation of the Weather Bureau (as to meteorology and hydrology), the Geological Survey (as to topography, hydrography, seismology, geology, and mineral springs), the several divisions of the Department of Agriculture (as to soils and forests), and the Coast and Geodetic Survey (as to magnetism, terrestrial gravity, and tides), our national government is now in a position to prepare a physical atlas of the United States, embracing every branch of terrestrial physics. An atlas that does not embrace all these must, necessarily, be incomplete and more or less unsatisfactory. A joint work for which each Department of the Government assumes the proper responsibility would respond to a recognized desideratum.

RECENT EARTHQUAKES.

Prof. Edward W. Morley, of Adelbert College, Cleveland, Ohio, and Prof. C. F. Marvin, of the Weather Bureau at Washington, report that no earthquakes have been recorded on their respective seismoscopes during December.

December 2.—Medicine Lodge, Kans.: about 12:45 a. m. a slight shock was experienced in this locality. Duration, about five seconds; direction, south to north. Rome, Kans.: about 1 a. m. Jefferson, Okla.: at 1:10 a. m. an earthquake shock, quite severe; rocked buildings, making them creak and crack; the disturbance seemed to be from northwest to southeast.

December 6.—Forest Grove, Oreg.: slight shock at 8:30 p. m.

December 15.—Waterville, Wash.: earthquake; duration four to six seconds; direction, northwest to southeast. Lakeside, Wash.: A severe shock.

December 15.—At 6:43 a. m., local time, severe earthquake, causing great damage throughout San Domingo. A second slight movement at 2 p. m. Churches and buildings were destroyed and railroad traffic interrupted. The submarine cable to Hayti was also affected. The grand edifice of Santo Cerro, in Santiago, in the interior of San Domingo, dating from the time of Columbus, was entirely destroyed. A continued repetition of harmless shocks occurred until the end of the month.

December 16, 17, 20.—Lakeside, Wash.: light shocks, all occurring at 6 a. m., vibrating from west to east.

December 18.—Earthquakes were reported at Ashland, Va., 6:54 p. m.; slight shock, with heavy rumbling noises, lasting from twenty to thirty seconds. Richmond, Va.: Shortly before 7 p. m. earthquake noticeable everywhere, but more violent in the eastern part of the city, toward Oakwood. At Oakwood it was heard and felt very distinctly. At Bonair and throughout Henrico County, Va., it was heard and felt; also at Buckingham and Maidens at 6:49 p. m., and at Fredericksburg.

December 26.—Centerville (P. O. Niles), Cal.: earthquake 7:06 a. m.; duration, five seconds; direction, north to south.

December 29.—Cockburn Town, Grand Turk, W. I.: Mr. Geo. J. Gibbs reports:

> On the morning of Wednesday the 29th day of December, 1897, at about 6:37 o'clock a. m., a slight shock of earthquake was felt at the Island of Grand Turk, lasting a few seconds. No damage was done; it was sufficiently strong, however, to stop the movement of the Government clock at the public buildings, and also several other timepieces in this town; symptoms of nausea were experienced by some of those who felt the trembling of the earth.

ELECTRIC STORMS AT SACRAMENTO.

The cause of the electrification of the atmosphere, from which follows the electrical phenomena of the thunderstorm, will, of course, not be understood until we have been able to explain how it happens that in some sections of the world there are so few thunderstorms, while in others they are of almost daily occurrence. A portion of California is singularly free from lightning, as shown by the following compilation from the records of the Weather Bureau station at Sacramento. The Weather Bureau station at this place was opened July 1, 1877, and the daily journal kept at the station probably affords a complete list of all the thunderstorms (viz, even a slight display of thunder or lightning) that have occurred. The following is the complete list of dates as corrected and continued from the list published on page 105 of Mr. Barwick's Monthly Bulletin of the California Weather Service for June, 1893:

1877.—July 20.
1878.—January 22; March 20; May 28; August 15.
1879.—March 30; April 4, twice; May 25; October 7.
1880.—March 3; June 11; July 25.
1881.—April 9, 21; May 23; June 3.
1882.—March 15; June 14; July 3; September 15.
1883.—March 27; May 6.
1884.—May 17, 18, 19.
1885.—April 2, 7, 8; September 5, 6; October 6.
1886.—January 20; March 4; April 9.
1887.—May 30; September 22; November 5.
1888.—May 12, 13; September 14, 15, three storms.
1889.—March 10, 20; April 2; October 8, 21; November 18.
1890.—February 16; May 10; December 3.
1891.—February 22; April 13; May 18; September 5.
1892.—September 26, 29, 30.
1893.—March 11; May 17; September 6.
1894.—May 25; June 17.
1895.—April 27; June 28; October 11.
1896.—May 27.
1897.—August 18, 19; December 1.

In most cases the display of lightning and thunder was very slight. The following notes refer to interesting cases:

1885, October 6, forked lightning occurred in the shape of a horseshoe.

1887, September 22, brilliant and long flashes of zigzag or forked lightning.

1888, September 14, 15, there were five distinct and severe storms with lightning and thunder in the vicinity of Sacramento during these two days.

1889, March 20, there was a succession of twelve flashes of zigzag lightning followed by as many loud peals of thunder; this was the longest display of lightning ever recorded here.

1889, April 2, a severe storm of forked lightning and thunder.

1891, September 5, a tree was struck by lightning.

1897, December 1, the second time that lightning occurred in December. The thunderstorm began at 4:05 a. m., seventy-fifth meridian time, and lasted about six minutes, during which time there were four flashes of lightning in the southwest, and the same number of loud peals of thunder. The lightning flash was of the zigzag or chain or forked variety, and was intensely white in color; the rainfall during the night (from 8 p. m. to 8 a. m.) was 0.10 inch; during these same twelve hours 5 inches of snow fell at Summit, 4 at Truckee, and 1 or 2 inches at other points on the mountains 50 or 100 miles west of Sacramento, and at points 3,000 feet or more above that station.

DISTANT CLOUD BANKS.

A letter from Mr. James Gun, of Durham, Grey County, Ontario, says:

I have often, when engaged in my practice in the country, observed these banks of clouds; especially when, having reached a height of land, I found myself placed in such a position that (by the refraction of the rays of light?) these clouds assumed the appearance of bodies of water, something after the appearance of a mirage. These cloud banks have been invariably, in my experience, followed by changes of weather and storms.

The Editor remembers to have seen in the distance about the time of sunset low clouds that closely resembled a distant lake or an ocean horizon. Of course the resemblance to such a solid mass of water was purely an optical delusion, and not due so much to the refraction that produces mirage, as to the peculiar tints of the blue sky, the clouds, and the ground at sunset. These were not the cloud banks that the Editor had especially in mind in his little note in the October REVIEW, but we are much obliged to Mr. Gun for calling our attention to them, and hope that other observers may put their observations on record.

CLOUDY CONDENSATION.

The researches of John Aitken, which have for the past twenty years been published from time to time in the "Transactions of the Royal Society of Edinburgh," have made the English-speaking world familiar with the fact that has been established by him and others, that whenever the aqueous vapor of the atmosphere condenses into the little globules that constitute fog or cloud it, by preference, condenses first upon the particles of so-called dust floating in the air which are, therefore, the nuclei of cloudy condensation. According to the last publication by Aitken (R. S. Edin., XXXIX, Part I, p. 15, 1897) he states that he has never said that dust particles are absolutely essential, but simply that as the air is full of dust and the condensation takes place on these by preference, therefore, practically all of our cloud particles have dust nuclei. The researches of Robert von Helmholtz and Professor Richarz and those of Prof. Carl Barus, as published by the Weather Bureau, agree with those of Aitken in showing that, in the absence of dust cloudy condensation also occurs, but the solid nuclei are replaced by molecules of some other foreign substances, such as the vapor of sulphuric acid, or the particles given off by anhydrous sulphuric acid, or even from metal surfaces when heated or electrified.

It has been suggested that, in the absence of dust nuclei, condensation may be produced by a molecular shock due to chemical processes, and more especially by the presence of the unsaturated molecular compounds known in chemistry as "ions." This last memoir by Aitken gives in detail an experimental method of determining the importance of these ions, especially those produced by the burning of pure hydrogen in pure air. Special pains were taken to obtain air and hydrogen perfectly free from dust, for when a single particle of dust is burned in the flame it gives rise to innumerable free atoms of carbon which becomes solid nuclei for condensation. Aitken's experiments show that in his apparatus the ions had no perceptible influence, whence he draws the safe conclusion that if they really had much influence in producing condensation they could have retained that power for only a very short time, viz, a fraction of a second, and it is not likely that they play any important part in the ordinary cloudy condensation of the atmosphere.

Mr. Aitken next turned his attention to the question of the direct influence of sunshine in producing condensation, a matter which was first brought to the attention of the world by the brilliant experiments of Tyndall, who describes the beautiful clouds produced by allowing a beam of light to pass through a long tube full of dustless, saturated vapor. Mr. Aitken finds that many of the vapors which we call impurities in our atmosphere, such as ammonia, nitric and nitrous acids, peroxide of hydrogen, sulphurous acid, sulphuretted hydrogen, hydrochloric acid, and chlorine give rise to nuclei of condensation when acted on by sunshine. Each of these, in a clean tube, was exposed to sunshine for about a minute. Ordinary pure air, after being filtered of dust and exposed to sunshine, does not show any cloudy condensation when expanded, but when any of the above-named gases are in the air a great deal of cloud is formed. Ammonia, after being sunned for a minute, has a very powerful effect; nitric acid not so much; nitrous acid probably as much as nitric acid. Hydrogen peroxide is a powerful generator of nuclei; sulphurous acid gives rise to condensation even in the dark and in a weak solution, but sunshine increases it; illuminating gas and the gases given off by the combustion of anthracite coal give a dense condensation after being exposed to sunshine, but these gases probably contain sulphur; pure sulphuretted hydrogen and hydrochloric acid give dense condensation after being exposed to the sunshine, but none when they are kept in the dark; chlorine causes condensation if kept in the dark and without being expanded and is still more fogged on exposure to sunlight. Some of these nuclei of condensation, due to the action of sunshine on the above-mentioned vapors, are very short lived, so that the air in the experimental flask loses the power of cloudy condensation in from fifteen to thirty minutes; but the nuclei from sulphurous acid do not lose their power for a long time; these nuclei are probably particles of fine sulphur dust and their action is as permanent as ordinary atmospheric dust. The light of burning magnesium acts on sulphurous acid easily, but scarcely at all on the other vapors. These experiments on the effects of sunshine on the gases ordinarily present in the atmosphere show that it is possible for cloudy condensation to take place in the absence of dust, since the sunshine may convert vapors into the nuclei of condensation. There is, indeed, always dust enough in the lower atmosphere, but we now see how it may become possible for clouds to form in the dustless higher strata.

ON THE TENSION OF AQUEOUS VAPOR.

Prof. Joseph Henry early called attention to the fact that the air is not necessarily saturated during rain, and he says (Smithsonian Annual Report, 1855, pp. 213–214, or Scientific Writings, Vol. II, p. 5):

That the air should ever be undersaturated during rain is at first thought a very surprising fact; it may, however, be accounted for on the principles of capillarity. The attraction of the surface of a spherical portion of water for itself is in proportion to the curvature or to the smallness of the quantity, and hence the tendency to evaporate from a raindrop ought to be much less than from an equal portion of a flat surface of water.

Mr. Aitken puts this principle in a very clear light, as follows:

> What is generally called a saturated vapor is one whose tension is equal to the tension of the vapor at a flat surface. Now this tension is not so high as the tension at a surface of extremely small convex curvature; and vapor that is in equilibrium with the vapor at a convex surface is supersaturated with reference to that at the flat surface; so that saturation is a relative and not an absolute quantity, relative to the curvature of the condensing surface, and a vapor that is supersaturated to a flat surface is not necessarily saturated to a surface of very small curvature. It would thus appear that there is no strain in a vapor till a surface makes its appearance, but after *it* is formed the lower tension at this surface determines a movement of the vapor molecules toward it. * * * From this way of considering the subject it would appear that there is no such thing as supersaturation in a pure vapor free from nuclei, consequently no strain in the vapor that needs to be relieved.

The figures for vapor tension, considered as a meteorological datum, should, of course, always be considered as reduced to the normal value for a flat surface, but this is only important for surfaces of very small curvature.

CYCLES IN METEOROLOGY.

The important and laborious computations by Mr. Dallas, the officiating meteorological reporter for the Government of India, as published in full in the current number of the MONTHLY WEATHER REVIEW, do not encourage further efforts to discover arbitrary cycles that are likely to be of importance either to meteorology or to the weather forecaster. If one had a myriad of observed temperatures, pressures, or rainfalls he could apply the harmonic analysis and represent the whole set of values accurately by a series of cycles, but every new observation of pressure, etc., would require the addition of a new cycle or the modification of an old one to represent it. The computations of Mr. Dallas have resulted in showing that an 11-year plus a 9-year cycle does not enable us to determine beforehand, with any certainty, the probable amount of the total annual rainfall. There are, of course, numerous coincidences between cyclic predictions and actual rainfall, but the frequent outstanding discrepancies are such as to rob the predictions of all real value. As with rainfall so with pressure; the departures of mean annual pressure from a uniform normal value are so small that we find ourselves discussing arbitrary cycles whose amplitudes are matters of 0.008 or 0.010 inch of pressure; these small quantities are at the very limit of the accuracy of our observations. If we apply the method of least squares to the differences between the observed and the computed values, we shall only arrive at a proper appreciation of the extrinsic but not of the intrinsic value of the cycles.

Arbitrary cycles are only resorted to when we have no clew to the rational connection between the phenomena and their ultimate causes. But the study of the motions of the earth's atmosphere has progressed far enough, both from an observational and a theoretical point of view to justify a determined effort to establish long-range forecasts of seasonal rainfall upon a higher plane than that of purely arbitrary cycles. Such higher methods may be empirical, but they are not necessarily arbitrary; they may be numerical and special, rather than analytical and general, but they may still be based upon a rational consideration of the mechanics of the atmosphere.

The laws of the mechanics of fluids show that there must be many temporary periods or cycles. Thus, for instance, if there are changes in the intensity of solar radiation, there must be corresponding immediate changes in the temperature, moisture, pressure, and motions of the atmosphere. Every such change of insolation will be perceived for a long time, possibly many years after its occurrence, by the existence of subsidiary phenomena that will spread over the entire globe until the whole influence of the change has permeated the atmosphere uniformly and the periodicities have died away.

On the other hand, without any change in solar or cosmic influences, but simply by reason of the production of rythmic changes as to pressure and wind within the atmosphere itself, the influence of that which is happening to-day in one region may be felt years hence far away. It other words, it is not necessary to go outside of the atmosphere to look for the origin of cycles and other less regular changes. The study of the droughts of recent years in the Southern Hemisphere (when elucidated by the study of a daily map, or even of a monthly summary of the conditions over the whole globe, and when interpreted by the general principle that rainfall at any locality depends directly upon the wind below and the currents above) shows why the drought of the South Pacific slowly advanced, month after month, northeastward into America, and eventually died away over Europe. The relation between the meteorology of Mauritius and that of India, as studied by Mr. Dallas, or the relation between India and the distant southern Indian Ocean, as studied by Mr. Eliot, or the relation between Australia and the South Pacific, on the one hand, and that of Hawaii and the North American Continent, on the other, as recently referred to by the Editor, is determined by the so-called general circulation of the atmosphere. This latter has certain broad features that result from the interaction of those portions of the atmosphere that are above the continents and the polar regions, upon those other portions that are above the oceans and the equatorial regions.

In seasonal predictions for large regions the general movements of the atmosphere and certain general principles in physics must be borne in mind. Consider first the connection between rainfall and the clouds. As a general rule, the lower the clouds the greater the chance that rain will fall from them. Now, the height of a cloud depends somewhat upon the method of formation. If the wind is blowing against a mountain side, the resulting cloud and its rain are due, primarily, to the dynamic cooling of expanding air; the height of the cloud will depend upon the dew-point and temperature of the air; the quantity of rain at any spot on the mountain will also depend upon the strength and persistency of the wind. This class of rains is well illustrated by the perpetual cloud and drizzle due to west winds on the summit of Pike's Peak or to the southeast trades on the summit of Green Mountain on the Island of Ascension, and also by the heavy rainfall during the southwest monsoon season on the windward side of the Ghats, and frequently also, of the Himalayas in India. On the other hand, when a warm wind is pushed aside and lifted up by an underflowing colder wind, as happens at the front of our "northers" and northwesters, we have not merely dynamic cooling due to ascent, but a still further cooling and, also, a drying due to the mixture of the two layers of air; the resulting clouds are colder because of this mixture, and the rainfall is less not only for this reason, but also because the mass of warm air and clouds is pushed forward, and is very soon entirely replaced by the advancing dry, cool, clear air. In general, clouds formed even partially by mixtures give little rain, but those due only to expansion give generous rain. The drizzles and daily showers from mixtures may, however, be very important to agriculture.

Consider now the layer of air next above the lowest. After the lower current has left a little rain on the windward side of a mountain range, it partially recurves as an overflow upon itself. The relative amount of the overflow depends upon the speed of the current and its depth as compared with the height of the mountain range. When that depth is considerably greater than the height of the obstacle the main part of the current goes on beyond the range as an upper current

over the continent, descending here and there to the earth's surface. All that portion of the continent that is under the influence of this descending wind is subject to dry, warm fœhn winds, and, at the best, relatively light rains. If the lower current on the windward side of the range is relatively feeble and but little rain is deposited on the windward side, then but little wind will flow thence over the continent, the volume of the descending dry fœhn winds will diminish, and the chances for local rains in the interior will increase.

In general, the quantity and frequency of rain depends upon the heights of clouds whose very formation itself depends upon the upper and lower winds. The absolute quantity of rain depends, also, upon the dew-point, and, other things being equal, is, therefore, greater for moist winds than for dry; but the relative quantity and the relative frequency of rain in successive seasons are the features that determine a drought, in ordinary agricultural usage, for any locality, and these depend essentially upon the relative movements of the atmosphere in the respective seasons. If the movements are downward, or feebly upward, or if they introduce cooler or drier air than usual, the result is drought; if they are more strongly upward than usual, they bring cloud and rain. These principles are abundantly illustrated by the winds and rains that prevail in the interior of India, Australia, and North America.

WATER MEASUREMENTS FOR IRRIGATION.

The attention of the Editor has been called to the fact that on page 209 of the MONTHLY WEATHER REVIEW for May, 1897, he has adopted the British Imperial gallon, which is used in many parts of this country, and has said nothing about the British wine gallon, which is also used. The imperial gallon contains 10 pounds of water, or 277.274 cubic inches. The wine gallon contains 8.3389 pounds of water, or 231 cubic inches. Records expressed in imperial gallons may be converted into wine gallons by multiplying them by the factor 10/8.3389 or 1.21.

CHINOOKS IN IOWA.

If the term "fœhn wind" is to be used as a general name for all warm, dry, descending winds then, of course, there may be a similar propriety in the use of the word "chinook," but as "fœhn" has the priority of many years of meteorological usage, and as we have both dry chinooks in Montana, and wet chinooks in Oregon and Washington, the Editor would prefer the unambiguous Swiss or Helvetian word "fœhn."

The Climate and Crop Report from Iowa for the month of December contains two interesting notes by observers. At Clarinda, A. S. Van Sandt says:

> On the morning of the 29th the wind was in the northwest, soon veering to west. It was as mild as May and reminded me of what I have read of the chinook. Query: Was it the tail end of one? The snow, which was very compact from previous melting, lost one-third of its depth.

At Odebolt, E. Starner says:

> December 4.—Chinook at midnight that settled the snow about 6 inches.

Before studying the weather maps to ascertain whether conditions were favorable for descending winds on these dates, the Editor would say that, in general, such winds may occur at any spot on the globe. The fact that they are peculiarly frequent and effective in certain regions, such as Switzerland, Greenland, western Montana, New Zealand, and northern India should not prevent us from recognizing the fact that they are recurring frequently in almost every other region. Whenever some air ascends other air must descend. There can be no doubt but that the famous hot winds that occur occasionally from Texas northward to Canada are descending winds.* It is scarcely proper to speak of the fœhn wind in Iowa as the tail end of a chinook that had spread from Montana down to that State, because both these terms are generally more restricted in extent. The hot winds of Iowa and of Montana are generally separate local chinooks.

On examining the weather maps for December 4 and 29, we find that on the morning of the 4th the temperature had risen remarkably in western Nebraska, eastern Wyoming, and northward through Dakota and Montana into Canada. The winds were from the southwest, the air was descending the eastern Rocky Mountain Slope, the pressure was 30.70 over the region around Salt Lake City, and 29.70, or less in Manitoba, everything was favorable for a chinook in the intermediate regions. By the 5th, a. m., the warm winds had covered a large region southeastward to the Mississippi Valley. Evidently the whole mass of air flowing eastward from the region of high pressure was descending along the surface of the ground and did not begin to rise until it came within the influence of the low pressure near the Lake Region. On the 4th, a. m., at Havre, Mont., the temperature was 56° higher than on the 3d, a. m. This was an intense chinook. Iowa had temperatures 12° or 14° higher, and during the whole day experienced a moderate chinook. All the intermediate regions had their descending dry and relatively warm winds.

On December 29 the conditions were very similar. The high pressure was over the Salt Lake region; the lowest pressure was over Lake Superior; the whole eastern Rocky Mountain Slope was covered with a layer of descending air, clear and dry, and, in general, warmer to such an extent that Iowa, Minnesota, and Wisconsin were from 20° to 50° warmer than on the 28th. The chinook—if it may be so called—prevailed from the Rocky Mountains eastward to the Mississippi. Iowa did not get the tail end of it but was in the midst of it.

If "chinook" and "fœhn" are terms that are to be restricted to intense local manifestations of descending winds, and if by the "hot winds" of the western plains we designate only those that occur at the time of the ripening of the wheat and corn, when they do such injury to crops, then we ought perhaps to devise some term specifically appropriate to these widespread areas of descending winds that bring dry, clear, warm weather to one-half of the Mississippi watershed.

Not only does the eastern slope of the Rocky Mountain region have its descending chinook winds, but so also has the eastern slope of the Appalachian range, a fact that was pointed out by the Editor as long ago as 1872. The westerly winds that bring fog and possibly rain or snow to Buffalo, Pittsburg, Knoxville, and Chattanooga frequently descend upon New York, Washington, Lynchburg, Columbia, S. C., and Atlanta as clear dry winds, and on the average a very little warmer than on the windward side of the mountain range. One of the first indications of this action of descending winds was observed soon after the station at Lynchburg was opened in 1871, when it was found that so-called clearing up weather and the first clear sky began at that station some hours before it reached Washington, and even a whole day earlier in the case of very slowly moving changes.

An area of high pressure apparently represents a region in which air is descending so slowly to the earth's surface that it cools by radiation faster than it warms up by compression. When such an area is central, as occurred so frequently during December, over the middle Plateau Region, the atmosphere is pushed not merely eastward down the eastern slope, but also northwestward into California, Oregon, and Washington. It is the relatively rapid descent down these slopes that causes the air, which is compressed by its own

*See the article "Summer Hot Winds on the Plains," by Dr. I. M. Cline, Weather Bureau Observer, in the Bull. Phil. Soc. Washington, XII, 1894.

weight, to become heated so rapidly as to produce a decided chinook; consequently, during the current December Mr. B. S. Pague, Section Director for Oregon, reports that—

> The month was generally warmer than usual, that in fact it was abnormal so far as the absence of any extreme cold is concerned. Two well-defined chinooks were experienced; viz, from the 5th to the 8th and from the 26th to the 28th.

These dates correspond to those of the warm winds on the eastern slope, showing that the same area of descending air can produce chinooks on both sides of the Plateau Region. Mr. Pague says:

> The cause of the mild temperature throughout the month was the dynamic heating of the air, due to the high pressures over the Plateau Region and the high latitude in which the low pressures passed from the ocean eastward. Had the high pressures been persistent to the north of Montana, then they would not have been over the Plateau Region, and the result would have been different; the low pressures would have traveled south of the normal path, and the cold air from the northeast would have lowered the temperatures much below the normal.

If the dry air from the Plateau Region descends with sufficient slowness it may cool by radiation rapidly enough to counterbalance the warming by compression. This latter warming is quite an exact quantity and amounts to about 1° C. for every 100 meters of descent, or to 1° F. for every 183 feet, consequently air that has descended 5,500 feet vertically must have been warmed up 30° F. Now, clear, dry air, rolling along on the surface of frozen or snow-covered ground in the winter season when the sun is low, can easily cool more than 30° in twenty-four hours. Thus, northerly winds and cold weather in Texas may sometimes be a direct continuation of air that was quite warm when it rapidly descended the eastern slope of the Rocky Mountains a few days before in Montana, Nebraska, or Kansas. But most frequently the cold waves of Texas are due to the southward flow of cold air from the Canadian regions into the Mississippi watershed; the divide between the Mississippi and Canada is scarcely 2,000 feet above sea level and the cold air generally lies below the 3,000-foot contour line. The progress of such a cold wave, south and east, is frequently described as dense air underflowing, pushing aside, and lifting up the warmer, lighter air of the Mississippi Valley. Above this cold air the observers on mountain tops and plateaus, or in balloons, generally find air that is potentially warmer, that is to say, air that if brought down to the earth's surface would by compression have a higher temperature than the air of the cold wave.

METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only the 8 p. m. observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation; the altitudes of the instruments, the total depth of snowfall, and the mean wet-bulb temperatures are now given.

Table II gives, for about 2,400 stations occupied by voluntary observers, the extreme maximum and minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 Canadian stations, the mean pressure, mean temperature, total precipitation, prevailing wind, total depth of snowfall, and the respective departures from normal values. Reports from Newfoundland and Bermuda are included in this table for convenience of tabulation.

Table IV gives detailed observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, meteorologist to the Government Survey.

Table V gives, for 26 stations, the mean hourly temperatures deduced from thermographs of the pattern described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table VI gives, for 26 stations, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table VII gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VIII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division one may obtain the average resultant direction for that division.

Table IX gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table X gives, for 56 stations, the percentages of hourly sunshine as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table XI gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XII gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the lowest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a trough or long oval area of low pressure.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level isobars, surface isotherms, and resultant winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are not reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and correspond to Professor Hazen's system of reduction; the barometer is not reduced to standard gravity, but the necessary reduction for 30 inches of the mercurial barometer is shown by the marginal figures for each degree of latitude.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Total snowfall in inches and limits of freezing weather.

Chart VII.—Depth of snow on ground at the close of the month.

TABLE I.—*Climatological data for Weather Bureau Stations, December*, 1897.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							32.8	+ 0.8									4.38	+ 0.7											
Eastport	76	69	74	29.92	30.01	+ .04	37.1	− 0.2	54	15	33	4	24	21	28	24	30	75	2.61	− 1.4	13	9,709	nw.	42	s.	1	5	12	14	6.8	4.9
Portland, Me	103	81	89	29.90	30.01	− .01	38.0	+ 0.4	55	11	34	5	25	32	25	36	33	82	4.32	+ 0.7	13	5,239	nw.	30	n.	18	7	8	16	6.5	12.1
Northfield	872	15	59	29.07	30.07	+ .02	32.4	+ 0.8	58	11	31	−10	29	14	37	30	17	84	3.36	+ 0.2	12	6,488	s.	35	nw.	18	4	7	20	7.2	6.4
Boston	135	115	181	29.92	30.06	+ .01	34.0	+ 1.3	64	10	40	9	25	28	26	31	26	77	3.92	+ 0.4	15	8,641	nw.	42	e.	14	9	5	17	6.4	7.8
Nantucket	14	43	54	30.05	30.06	.00	37.5	+ 2.4	57	11	42	17	24	32	22	35	31	80	3.17	− 1.1	16	8,920	nw.	40	nw.	24	6	4	21	7.6	6.6
Woods Hole	.....	51	57	.....	.....	.....	35.8	− 0.6	57	15	41	13	25	31	26	.....	.....	.....	4.18	+ 0.7	14	12,596	se.	54	nw.	18	9	9	13	5.7	3.6
Vineyard Haven	.....	30	.....	.....	.....	.....	38.2	+ 0.8	62	11	44	15	25	32	23	.....	.....	.....	4.51	+ 0.7	15	.....	nw.	.....	.....	.....	8	7	16	....	6.2
Block Island	27	39	48	30.04	30.08	+ .02	36.8	− 0.4	57	15	42	13	24	32	21	35	30	77	5.61	+ 1.9	17	12,763	nw.	54	e.	14	6	14	11	5.8	2.7
Narragansett Pier	.....	10	.....	.....	.....	.....	34.8	+ 2.0	56	*	42	10	*	28	26	.....	.....	.....	6.70	+ 3.0	13	.....	nw.	.....	.....	.....	12	3	16	....	5.5
New Haven	107	118	140	29.95	30.07	− .02	33.8	+ 1.3	57	11	40	10	25	28	28	30	26	77	5.61	+ 2.2	14	6,731	w.	35	nw.	24	6	7	18	6.7	6.2
Mid. Atlan. States.							36.6	+ 0.9									3.81	+ 0.6											
Albany	97	84	113	29.98	30.09	+ .01	30.1	− 0.2	58	11	36	4	29	24	32	28	25	82	4.38	+ 1.6	15	5,964	s.	30	s.	1	5	4	22	7.7	9.6
Binghamton	875	79	90	.....	.....	.....	30.2	.....	61	10	36	0	29	24	34	.....	.....	.....	3.23	.....	18	5,470	w.	37	se.	14	4	7	20	7.7	17.9
New York	314	298	326	29.74	30.09	− .01	35.8	0.0	60	11	42	9	24	30	20	32	28	77	4.83	+ 1.5	12	9,140	nw.	48	nw.	24	8	9	14	6.2	2.9
Harrisburg	377	94	102	29.70	30.12	− .04	35.6	+ 1.2	63	11	41	13	25	30	25	32	26	71	3.21	+ 0.2	11	5,915	w.	40	w.	24	4	7	20	7.3	4.7
Philadelphia	117	168	184	29.98	30.11	− .02	38.1	+ 2.3	63	10	44	16	24	32	25	34	30	77	4.52	+ 1.8	12	7,563	nw.	37	nw.	31	5	13	13	6.7	1.7
Atlantic City	52	68	76	30.05	30.11	.00	38.4	+ 1.6	58	12	45	15	25	32	24	36	34	86	3.55	− 0.3	13	8,377	nw.	41	nw.	24	8	13	10	6.1	0.2
Baltimore	123	68	82	29.97	30.10	− .04	42.6	+ 0.1	66	11	45	16	24	32	23	34	30	75	3.40	+ 0.2	15	3,526	nw.	22	w.	31	8	13	10	5.8	2.6
Washington	112	59	76	30.01	30.13	− .03	38.1	+ 0.3	68	11	46	14	25	30	31	34	30	76	3.35	+ 0.4	12	5,056	s.	34	nw.	24	12	9	10	4.9	2.0
Cape Henry	.....	5	34	.....	.....	.....	45.2	+ 2.4	71	11	52	19	24	38	24	.....	.....	.....	3.57	− 0.3	10	.....	nw.	.....	.....	.....	9	6	16	....	T.
Lynchburg	685	83	88	29.39	30.15	− .01	40.7	+ 0.8	71	11	49	16	25	32	37	36	32	76	3.37	+ 0.3	11	3,192	sw.	28	nw.	23	10	11	10	5.5	T.
Norfolk	57	88	93	30.08	30.15	+ .01	45.1	+ 0.9	72	11	52	22	24	38	27	41	38	81	3.88	+ 0.2	9	6,298	ne.	38	nw.	24	8	8	15	6.4	
Richmond	144	98	105	.....	.....	.....	41.6	.....	68	10	50	19	25	34	31	.....	.....	.....	2.63	.....	10	4,960	n.	25	sw.	14	9	8	14	6.3	
S. Atlantic States.							43.9	+ 1.0									3.65	+ 0.1											
Charlotte	773	68	76	29.30	30.14	− .03	44.2	+ 0.3	69	10	52	24	25	37	25	40	36	78	2.52	− 1.6	15	4,984	ne.	30	sw.	31	10	10	11	5.9	T.
Hatteras	11	17	36	30.13	30.14	.00	50.6	+ 2.4	72	11	56	29	24	46	22	48	46	86	7.81	+ 2.3	12	9,994	n.	45	sw.	5	13	9	9	5.2	
Kittyhawk	9	12	30	.....	.....	.....	48.8	+ 3.7	70	11	55	36	*	42	23	.....	.....	.....	5.87	+ 1.7	8	.....	.....	.....	.....	.....	19	4	8	....	
Raleigh	375	93	101	29.76	30.17	− .03	44.0	+ 0.8	68	9	52	21	25	36	32	40	36	76	2.56	− 0.2	12	4,213	n.	25	nw.	31	10	7	14	6.0	T.
Wilmington	78	82	90	30.08	30.17	+ .01	49.4	+ 0.2	70	11	58	26	25	40	32	45	43	86	4.38	+ 1.4	12	5,304	w.	32	w.	26	12	6	13	5.5	
Charleston	48	60	72	30.14	30.19	+ .03	54.0	+ 2.1	72	18	61	30	26	47	23	48	44	75	2.35	− 0.9	9	6,853	n.	33	nw.	26	7	15	9	5.7	
Columbia	.....	5	.....	.....	.....	.....	47.2	− 1.3	75	10	58	27	29	37	39	.....	.....	.....	1.90	− 1.0	10	.....	nw.	.....	.....	.....	11	4	16	....	
Augusta	180	89	103	29.97	30.17	+ .01	48.6	− 0.9	72	10	59	29	28	38	34	43	40	80	1.98	− 1.4	10	4,349	w.	36	sw.	31	12	7	12	5.7	
Savannah	82	63	86	30.08	30.18	.00	53.7	+ 0.8	77	11	63	36	25	45	28	48	45	83	2.26	− 1.0	8	5,389	nw.	27	nw.	31	13	4	14	5.6	
Jacksonville	43	69	84	30.12	30.17	+ .01	58.5	+ 1.8	80	4	68	36	28	49	29	53	51	87	4.84	+ 2.0	11	4,495	ne.	25	sw.	31	12	14	5	5.0	
Florida Peninsula.							67.9	+ 1.0									2.18	0.0											
Jupiter	28	13	30	30.12	30.15	− .02	68.8	+ 1.2	83	22	74	49	29	63	20	62	60	78	1.96	− 0.7	8	6,886	nw.	28	s.	25	8	9	14	6.2	
Key West	22	42	50	30.13	30.15	+ .03	72.4	+ 2.1	83	3	76	51	28	69	17	67	65	79	2.07	+ 0.4	7	7,919	ne.	30	n.	28	12	14	5	4.5	
Tampa	36	60	67	30.13	30.17	+ .01	62.5	− 0.3	82	3	72	40	6	53	27	56	54	81	2.50	+ 0.2	8	4,244	n.	30	s.	25	14	11	6	4.3	
East Gulf States.							53.5	+ 0.6									4.96	0.6											
Atlanta	1,131	92	126	28.95	30.18	− .02	45.3	0.0	67	10	52	27	5	38	26	42	40	87	3.00	− 1.4	15	7,244	nw.	36	nw.	31	4	10	17	7.2	T.
Pensacola	56	78	90	30.12	30.18	+ .02	56.2	+ 0.9	76	3	64	32	5	42	25	53	50	82	2.86	− 1.0	11	6,348	n.	44	sw.	13	11	10	10	5.3	
Mobile	57	88	96	30.11	30.18	+ .01	54.0	+ 1.2	74	3	62	29	5	46	31	51	49	86	4.97	+ 0.5	11	5,238	nw.	36	s.	13	9	4	18	6.9	
Montgomery	221	100	107	29.92	30.16	− .02	51.2	+ 0.7	74	30	60	31	6	42	33	47	44	83	3.37	− 1.3	8	5,047	nw.	29	w.	10	8	8	15	6.0	
Vicksburg	254	65	73	29.86	30.13	− .05	49.2	− 1.1	74	9	58	25	5	41	29	45	42	84	3.27	+ 8.3	13	6,045	se.	34	nw.	31	10	5	16	6.3	
New Orleans	54	112	120	30.10	30.16	+ .02	57.0	+ 0.5	77	20	64	34	5	50	25	53	50	82	4.00	− 0.4	9	7,100	se.	35	nw.	31	16	5	10	4.5	
Port Eads	.....	27	.....	.....	.....	.....	61.6	+ 2.1	77	2	68	38	5	56	24	.....	.....	.....	3.27	− 0.2	8	.....	nw.	.....	.....	.....	9	13	9	....	
West Gulf States.							47.9	− 3.2									4.09	+ 0.8											
Shreveport	249	77	84	29.87	30.15	− .01	47.8	− 1.5	74	8	56	19	4	39	33	42	38	76	5.22	+ 0.5	11	6,301	se.	35	w.	13	8	8	15	6.1	
Fort Smith	481	63	72	29.60	30.13	− .03	38.9	− 4.3	72	9	48	14	4	30	35	35	31	77	6.04	+ 2.9	11	5,321	e.	35	nw.	31	9	7	15	6.0	2.2
Little Rock	302	71	79	29.82	30.16	− .01	40.4	− 4.8	71	8	49	20	4	32	34	37	34	83	5.57	+ 1.3	12	5,792	w.	36	nw.	31	6	9	16	7.1	4.0
Corpus Christi	20	42	50	30.14	30.16	+ .02	54.6	− 2.5	78	2	61	29	4	48	31	50	48	85	1.08	− 0.2	12	7,657	n.	34	n.	3	12	9	10	4.9	
Galveston	42	85	96	30.10	30.14	.00	55.4	− 2.6	71	8	61	30	4	50	34	52	50	86	2.58	− 1.4	13	8,835	n.	41	n.	3	12	3	16	5.8	
Palestine	510	54	61	29.59	30.16	− .01	47.4	− 3.0	74	9	55	18	4	40	33	43	39	79	6.81	+ 3.0	13	5,273	s.	36	nw.	13	10	6	15	6.1	T.
San Antonio	704	95	104	29.40	30.17	+ .02	51.1	− 3.7	78	8	61	29	4	42	34	44	38	70	1.34	− 0.6	11	6,623	n.	38	n.	31	13	7	11	4.9	
Ohio Val. & Tenn.							38.1	− 0.4									4.12	+ 0.6											
Chattanooga	762	106	112	29.35	30.18	− .01	43.8	0.0	66	10	51	24	24	36	32	40	37	82	6.91	+ 2.4	17	5,486	sw.	40	w.	31	1	13	17	7.4	T.
Knoxville	1,004	80	88	29.07	30.17	− .03	41.6	+ 0.9	65	10	50	18	24	34	31	38	35	83	5.42	+ 1.3	17	5,604	sw.	48	w.	31	5	6	20	7.4	0.3
Memphis	399	140	154	29.71	30.15	− .03	41.4	− 2.1	70	9	48	22	5	34	30	38	34	77	5.80	+ 1.6	14	7,803	sw.	48	nw.	31	6	10	15	6.9	6.0
Nashville	545	128	134	29.55	30.15	− .01	41.8	− 0.4	67	9	49	19	24	34	40	38	34	79	4.93	+ 1.2	15	5,570	s.	45	nw.	31	3	7	21	7.9	4.1
Lexington	989	75	122	29.02	30.12	− .05	36.8	− 0.4	67	9	44	8	24	30	28	34	30	77	5.11	+ 1.8	14	9,238	sw.	40	sw.	5	3	6	22	8.0	6.4
Louisville	525	114	136	29.54	30.13	− .04	37.9	− 0.6	70	9	44	13	24	32	24	34	30	75	3.05	− 0.8	12	6,949	s.	28	sw.	4	2	6	23	8.3	4.4
Evansville	.....	.....	.....	.....	.....	.....	36.4	.....	68	10	42	15	24	31	19	.....	.....	.....	2.91	.....	12	.....	sw.	36	sw.	29	6	6	19	7.1	0.7
Indianapolis	823	154	164	29.21	30.13	− .01	31.2	− 2.3	62	9	37	6	24	25	21	29	26	79	3.09	− 0.1	14	8,357	nw.	37	sw.	29	2	8	21	8.1	6.7
Cincinnati	628	152	157	29.43	30.14	− .02	36.3	− 0.9	66	10	42	10	24	30	24	33	30	79	2.32	− 0.8	14	6,626	sw.	29	nw.	17	5	10	16	7.1	3.3
Columbus	834	87	100	29.19	30.11	− .03	33.6	− 0.6	64	9	40	7	24	28	29	31	29	84	2.13	− 0.5	10	6,398	w.	27	se.	4	5	10	16	6.9	4.0
Pittsburg	842	116	123	29.17	30.11	− .02	36.9	+ 1.1	65	9	43	9	24	31	30	34	32	85	3.44	+ 0.6	14	5,693	sw.	28	w.	5	0	9	22	8.4	10.4
Parkersburg	638	77	84	29.43	30.14	− .05	37.3	+ 1.1	67	10	44	11	24	30	31	34	31	81	2.85	− 0.4	16	3,128	sw.	30	nw.	17	2	4	25	8.3	3.9
Lower Lake Region.							32.2	− 1.0									2.43	− 0.4											
Buffalo	768	178	206	29.19	30.05	− .01	30.2	− 0.3	59	10	36	1	24	25	28	28	24	75	3.59	+ 0.2	19	13,036	w.	60	w.	5	0	7	24	8.8	11.4
Oswego	335	76	87	29.66	30.04	− .02	29.2	− 0.2	59	10	35	4	28	23	25	27	24	83	3.60	+ 0.2	23	9,779	se.	38	n.	31	0	5	26	9.1	12.3
Rochester	523	81	90	29.45	30.04	− .02	30.0	+ 0.5	62	10	36	3	24	24	31	28	24	79	3.39	+ 0.5	24	6,483	sw.	28	sw.	30	1	5	25	8.8	18.4
Erie	714	92	102	29.27	30.07	.00	32.4	− 1.1	61	10	38	9	25	27	30	30	27	85	2.73	− 0.5	21	9,832	sw.	45	s.	14	0	5	26	8.2	5.1
Cleveland	762	190	201	29.22	30.08	− .01	31.6	+ 0.1	60	11	37	8	25	26	30	29	25	76	1.36	− 1.3	14	11,926	w.	56	nw.	23	0	4	27	9.1	4.4
Sandusky	629	62	74	29.38	30.09	− .01	31.6	− 0.7	62	11	37	3	24	26	27	29	25	78	1.54	− 0.9	13	6,972	w.	38	nw.	23	2	2	27	8.7	2.5
Toledo	674	122	127	29.33	30.09	.00	29.4	− 2.1	57	9	35	1	24	24	23	27	24	80	1.30	− 1.1	9	7,966	w.	34	sw.	29	3	4	24	8.0	4.5
Detroit	730	160	166	29.25	30.08	.00	27.5	− 4.0	54	10	33	− 2	24	22	21	26	24	85	1.95	− 0.6	14	7,155	w.	36	s.	29	5	9	17	7.1	9.1
Upper Lake Region.							22.2	− 2.8									2.01	− 0.2											
Alpena	609	61	65	29.31	30.01	− .02	24.8	− 0.2	49	9	30	0	24	20	21	24	21	85	2.47	0.0	16	6,786	w.	32	nw.	23	0	11	20	8.5	16.5
Grand Haven	628	55	64	29.33	30.05	.00	28.8	− 1.2	57	10	34	8	24	23	26	27	25	87	2.74	+ 0.1	18	8,693	nw.	40	sw.	29	0	1	30	9.5	14.9
Marquette	734	67	95	29.16	30.00	− .03	20.5	− 2.8	48	9	26	− 5	17	15	37	19	17	88	1.77	− 0.7	18	7,842	nw.	34	s.	29	0	10	21	8.4	21.2
Port Huron	639	70	108	29.34	30.07	.00	27.4	− 0.9	54	10	33	− 2	24	21	23	25	22	81	2.27	0.0	18	8,658	sw.	37	sw.	5	1	12	18	7.3	10.1
Sault Ste. Marie	634	58	65	29.28	30.00	.00	18.9	− 3.0	45	9	26	−16	24	12	30	18	16	86	2.73	+ 0.6	18	6,511	e.	30	nw.	16	1	4	26	8.9	21.7
Chicago	824	241	274	29.17	30.10	+ .02	25.0	− 4.5	57	9	31	− 2	18	19	31	24	21	84	1.62	− 0.7	12	13,573	w.	56	sw.	16	6	7	18	6.9	6.2
Milwaukee	671	106	149	29.33	30.10	+ .02	22.4	− 3.9	54	10	29	− 5	18	16	35	20	16	77	2.42	+ 0.4	14	8,185	w.	33	w.	16	7	5	19	6.9	14.2
Greenbay	617	49	57	29.37	30.08	+ .02	18.1	− 4.9	46	9	25	−10	2	11	40	16	12	78	1.20	− 1.3	9	6,022	sw.	30	w.	29	5	15	11	6.2	12.1
Duluth	702	95	106	29.26	30.07	− .01	14.2	− 3.8	40	9	21	−15	17	7	29	12	10	85	0.85	− 0.5	8	6,687	sw.	46	nw.	16	8	9	14	6.1	10.4
North Dakota.							13.1	+ 0.3									0.25	− 0.4											
Moorhead	935	54	60	29.00	30.13	− .02	10.6	− 0.4	44	29	19	−19	17	2	37	9	7	89	0.28	− 0.4	6	6,431	se.	30	nw.	29	8	12	11	5.3	2.8
Bismarck	1,674	16	29	28.24	30.15	+ .01	14.0	− 0.2	52	8	24	−23	2	4	39	10	3	64	0.30	− 0.4	7	5,594	nw.	40	nw.	6	14	5	12	5.5	2.9
Williston	1,875	15	31	27.99	30.12	− .05	14.6	+ 1.6	49	28	24	−25	2	5	36	13	6	79	0.16	− 0.5	4	6,131	nw.	48	w.	24	15	13	3	4.1	1.2
Upper Miss. Valley.							23.2	− 5.0									1.37	− 0.1											
Minneapolis	.....	99	.....	.....	.....	.....	15.2	− 4.9	46	9	22	−13	16	8	30	.....	.....	.....	0.13	− 1.3	3	.....	nw.	.....	.....	.....	7	9	15	....	1.5
St. Paul	837	114	124	29.15	30.13	+ .02	15.4	− 3.8	45	9	23	−12	16	8	24	13	10	79	0.20	− 1.1	4	5,625	nw.	26	nw.	29	9	10	12	5.6	2.1
La Crosse	.....	70	78	.....	.....	.....	16.8	− 7.2	46	9	24	− 9	18	9	23	.....	.....	.....	0.80	− 0.6	12	5,105	nw.	30	w.	16	7	13	11	6.1	13.2
Davenport	599	71	79	29.42	30.12	− .01	22.9	− 5.4	57	9	31	− 4	18	15	39	20	16	78	1.53	− 0.2	9	5,798	nw.	40	w.	16	7	9	15	6.5	6.5
Des Moines	867	84	88	29.19	30.19	+ .04	19.6	− 6.4	49	8	28	−13	18	11	32	18	15	81	1.98	+ 0.5	12	5,788	nw.	28	nw.	5	15	3	13	5.2	19.6
Dubuque	698	49	56	29.32	30.13	+ .02	19.8	− 5.9	46	9	27	− 6	18	12	40	17	13	79	2.08	+ 0.3	11	5,484	nw.	26	nw.	31	10	10	11	5.9	14.8

TABLE I.—*Climatological data for Weather Bureau Stations, December*, 1897—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometers above ground.	Pressure, in inches: Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Up. Miss. Val.—Con																															
Keokuk	614	64	78	29.45	30.15	+ .02	25.0	— 4.8	59	10	33	— 2	18	17	38	22	20	84	1.84	— 0.1	8	5,996	nw.	35	nw.	16	7	10	14	6.4	7.4
Cairo	359	87	93	29.72	30.13	— .02	36.8	— 2.7	68	9	43	16	18	30	23	35	33	88	3.69	+ 0.4	11	6,729	sw.	36	ne.	13	2	5	24	8.2	T.
Springfield, Ill	644	82	92	29.40	30.12	— .03	28.0	— 5.3	60	9	34	2	18	22	31	25	21	77	3.07	+ 0.3	10	7,635	nw.	28	ne.	13	3	7	21	7.7	2.6
Hannibal	534	75	107	.....	.....	.....	26.8	.....	64	9	35	— 6	18	18	34	....	....	...	1.86	+ 0.1	11	7,156	w.	38	sw.	10	5	9	17	7.1	7.4
St. Louis	567	110	210	29.51	30.15	.00	32.8	— 3.5	64	9	39	10	18	26	28	30	26	79	3.43	+ 0.6	11	7,306	w.	28	sw.	29	2	8	21	8.1	4.3
Missouri Valley.							23.8	— 4.8											1.74	+ 0.5											
Columbia	.....	4	84	.....	.....	.....	29.4	— 5.7	66	9	38	5	18	21	32	....	....	....	2.30	+ 0.2	9	7,089	n.	38	nw.	31	3	9	19	7.7	2.7
Kansas City	963	78	95	29.10	30.19	+ .01	28.0	— 5.3	68	9	35	3	16	21	35	25	20	75	1.36	— 0.2	9	6,365	nw.	31	nw.	31	5	8	18	7.0	11.3
Springfield, Mo	1,324	164	103	28.66	30.13	— .01	32.4	— 4.6	64	9	39	10	17	25	25	29	26	82	4.58	+ 1.7	10	8,311	nw.	36	nw.	31	4	13	14	6.8	2.0
Topeka	.....	81	....	.....	.....	.....	28.2	— 6.0	65	9	36	3	16	21	30	....	....	....	1.15	+ 0.1	7	.....	nw.	....	.....	...	5	14	12	....	9.8
Lincoln	1,199	74	84	28.82	30.19	.....	22.6	— 7.8	53	8	30	—18	18	15	31	19	15	76	2.10	+ 1.4	8	7,715	nw.	40	nw.	31	8	12	11	5.8	21.0
Omaha	1,103	92	97	28.94	30.19	+ .01	21.8	— 5.2	47	29	28	—12	18	15	33	20	17	84	1.79	+ 0.8	12	5,677	nw.	25	nw.	5	9	7	15	6.3	17.9
Sioux City	1,139	96	164	.....	.....	.....	18.3	— 5.8	48	28	27	—15	18	10	34	....	....	....	1.64	+ 0.5	9	8,202	nw.	53	nw.	16	8	7	16	6.6	26.4
Pierre	1,460	50	61	28.49	30.14	— .03	20.6	— 4.1	58	7	30	—17	17	12	55	18	15	83	0.47	0.0	9	5,050	nw.	36	n.	15	9	7	15	5.8	4.4
Huron	1,306	56	67	28.67	30.18	— .01	16.0	— 2.2	48	29	24	—20	4	8	58	15	13	89	0.57	0.0	12	7,023	nw.	40	nw.	4	11	5	15	6.3	5.5
Yankton	1,234	52	58	.....	.....	.....	20.2	— 1.0	52	8	28	—12	18	12	42	...	....	....	1.53	+ 0.7	11	5,906	n.	38	nw.	15	10	7	14	5.9	20.6
Northern Slope.							21.8	— 2.5											0.63	+ 0.2											
Havre	2,494	15	33	27.33	30.11	— .04	18.4	+ 0.7	51	28	28	—43	2	9	68	16	13	79	0.26	— 0.3	7	9,389	sw.	60	nw.	26	15	13	3	4.3	2.0
Miles City	2,372	41	49	27.52	30.17	+ .01	18.8	— 0.5	51	28	29	—31	3	9	39	16	13	82	0.26	0.0	6	4,931	sw.	36	w.	26	12	11	8	4.8	2.6
Helena	4,108	88	93	25.88	30.26	+ .09	23.8	+ 0.1	55	27	31	—16	16	16	39	20	15	69	0.59	— 0.3	10	5,791	sw.	45	sw.	29	5	13	13	6.1	5.1
Rapid City	3,251	46	50	26.61	30.14	— .04	25.7	— 4.2	64	28	36	—13	3	15	39	21	14	68	0.12	— 0.1	6	5,870	nw.	39	nw.	30	14	13	4	4.0	1.2
Cheyenne	6,105	58	60	23.96	30.28	+ .11	25.0	— 4.5	52	8	35	— 6	16	15	45	19	9	54	1.27	+ 1.0	7	10,085	nw.	50	w.	7	9	15	7	4.9	12.7
Lander	5,372	28	36	24.66	30.33	+ .15	16.0	— 6.7	48	29	29	—21	16	3	47	13	9	80	1.29	+ 0.8	5	2,708	sw.	32	sw.	14	13	13	5	4.3	12.9
North Platte	2,836	43	52	27.13	30.24	+ .05	25.2	— 2.5	56	29	35	— 9	4	16	43	20	15	73	0.63	+ 0.1	7	6,517	w.	35	nw.	30	17	8	6	4.1	7.8
Middle Slope.							30.5	— 4.4											0.62	— 0.3											
Denver	5,290	79	151	24.72	30.27	+ .09	28.3	— 5.7	62	7	41	— 8	16	16	48	21	10	53	0.63	0.0	8	6,623	s.	53	w.	7	14	9	8	4.5	8.3
Pueblo	4,713	74	81	25.31	30.25	+ .12	29.0	— 5.7	70	8	44	— 4	20	14	51	22	12	58	0.39	— 0.1	5	4,895	nw.	39	nw.	7	15	11	5	4.5	2.1
Concordia	1,398	42	47	28.62	30.20	+ .05	27.5	— 5.0	61	8	36	— 5	18	19	31	23	21	85	0.85	+ 0.4	8	4,590	s.	27	nw.	31	13	11	7	4.9	8.5
Dodge City	2,504	44	52	27.47	30.21	+ .05	30.7	— 2.4	68	8	43	— 1	3	19	40	24	17	67	0.20	— 0.4	3	7,810	nw.	48	nw.	30	20	5	6	3.6	2.3
Wichita	1,351	78	85	28.68	30.18	+ .05	32.0	— 2.6	61	8	41	4	3	23	35	27	21	70	0.97	0.0	5	6,994	nw.	31	n.	13	15	8	8	4.6	6.3
Oklahoma	1,218	54	53	28.82	30.18	+ .04	35.6	— 4.9	70	9	46	6	4	26	41	31	27	77	0.70	— 1.7	8	7,920	n.	38	s.	15	15	6	10	4.6	0.9
Southern Slope.							38.4	— 3.6											0.58	— 0.6											
Abilene	1,749	47	54	28.32	30.22	+ .04	42.8	— 3.9	79	8	54	15	4	31	43	35	28	66	0.52	— 1.0	6	6,918	n.	48	nw.	12	15	4	12	4.7	1.5
Amarillo	3,691	54	61	26.31	30.21	+ .05	34.0	— 2.5	72	8	46	— 1	3	22	42	27	19	62	0.63	— 0.2	7	10,248	n.	56	n.	12	19	7	5	3.4	4.3
Southern Plateau.							43.8	— 3.2											0.24	— 0.5											
El Paso	3,767	10	110	26.27	30.19	+ .03	44.2	— 0.9	71	12	58	18	5	30	40	33	16	40	0.09	— 0.4	2	7,811	nw.	45	nw.	12	20	8	3	2.5	T.
Santa Fe	6,998	47	50	23.26	30.21	+ .06	29.2	— 3.5	53	1	39	8	20	19	29	23	14	56	0.64	— 0.2	6	5,408	ne.	36	nw.	12	23	6	2	2.8	8.6
Phœnix	1,076	47	57	28.94	30.10	.....	48.8	— 4.2	79	31	64	23	22	34	40	38	25	45	0.17	— 1.0	2	2,293	w.	28	w.	2	23	4	4	2.6	
Yuma	139	16	50	29.97	30.12	+ .06	52.9	— 4.4	75	31	66	28	17	40	37	41	25	35	0.04	— 0.4	1	5,650	n.	...	.....	...	26	5	0	1.2	
Middle Plateau.							29.6	— 4.2											1.38	— 0.3											
Carson City	4,720	82	92	25.39	30.30	.....	32.3	— 2.6	61	13	45	4	20	20	41	27	20	67	1.71	— 0.5	8	4,240	sw.	57	sw.	6	12	12	7	4.6	2.9
Winnemucca	4,340	59	70	25.79	30.30	+ .09	29.0	— 2.8	57	7	41	— 2	22	17	40	....	20	69	0.97	— 0.3	6	.....	s.	....	.....	...	8	14	9	5.3	3.4
Salt Lake City	4,344	83	90	25.79	30.38	+ .14	27.4	— 7.1	52	14	35	2	21	20	23	25	20	74	1.47	— 0.2	9	3,436	se.	30	s.	14	13	6	12	5.0	8.8
Northern Plateau.							28.4	— 1.7											2.16	+ 0.2											
Baker City	3,470	49	55	26.57	30.29	+ .12	28.5	0.0	45	28	34	5	19	23	19	26	22	77	1.54	— 0.2	16	4,325	se.	27	w.	8	4	9	18	7.3	9.7
Idaho Falls	4,742	10	56	25.36	30.39	+ .16	19.0	— 3.7	41	8	28	—14	20	10	35	18	16	87	1.59	0.0	15	5,841	n.	37	s.	14	11	0	20	6.6	12.4
Spokane	1,943	99	107	28.09	30.22	+ .10	30.2	— 0.6	51	28	35	5	18	25	20	29	26	82	3.05	+ 0.5	17	4,379	s.	34	sw.	7	4	3	24	8.3	6.3
Walla Walla	1,018	65	73	29.10	30.23	+ .14	35.7	— 2.4	62	27	40	15	19	31	25	33	30	84	2.44	+ 0.3	17	4,447	s.	34	s.	13	1	18	12	7.1	2.6
N. Pac. Coast Reg.							43.8	+ 1.1											13.02	+ 5.7											
Fort Canby	179	10	34	29.85	30.05	+ .09	44.4	+ 0.2	52	*	47	33	18	42	13	43	41	87	14.11	+ 4.2	22	16,040	e.	86	s.	6	5	5	21	7.8	
Port Angeles	29	47	62	.....	.....	.....	41.0	+ 2.8	52	28	45	30	15	37	16	....	....	....	9.85	+ 4.7	22	3,316	sw.	36	w.	28	2	4	25	8.7	
Pysht *a*	.....	5	....	.....	.....	.....	41.6	.....	54	27	45	30	*	38	14	....	....	....	18.98	+ 8.4	22	.....	e.	....	.....	...	3	2	25	....	
Seattle	119	100	108	29.95	30.08	.....	42.6	.....	54	5	46	29	3	39	15	41	38	85	11.80	.....	20	5,466	se.	37	se.	6	3	6	22	8.1	
Tacoma	213	....	....	.....	.....	.....	41.7	.. .. .	55	6	46	28	3	38	15	..	....	....	14.48	.....	21	4,790	sw.	35	sw.	8	2	3	26	8.7	
Tatoosh Island	86	7	21	29.90	30.00	+ .07	44.0	+ 0.3	52	6	47	36	18	41	14	43	40	81	17.50	+ 3.0	23	13,286	e.	63	e.	31	4	3	24	8.3	
Astoria	.....	39	60	.....	.....	.....	45.2	+ 0.7	56	13	49	33	19	41	16	..	....	....	16.05	+ 4.9	21	.....	e.	....	.....	...	3	5	23	....	
Portland, Oreg	153	203	213	29.96	30.13	+ .05	43.2	+ 1.2	59	27	48	27	23	38	19	40	37	81	8.84	+ 1.1	22	8,321	s.	48	se.	6	4	10	17	7.2	0.2
Roseburg	521	56	67	29.58	30.15	+ .03	44.8	+ 1.5	63	27	50	29	3	40	22	42	39	83	5.82	— 0.6	18	2,277	s.	32	sw.	7	3	10	18	7.8	0.1
Mid. Pac. C'st Reg.							48.4	— 0.9											2.55	— 3.0											
Eureka	64	60	69	30.14	30.20	+ .12	48.6	+ 0.1	64	31	55	32	19	42	24	45	42	81	6.18	— 2.0	15	4,253	sw.	33	se.	5	12	8	11	5.1	
Redbluff	334	54	58	29.87	30.23	+ .10	46.0	— 1.5	67	31	55	27	22	37	33	41	36	71	1.86	— 3.4	7	4,011	n.	25	se.	7	18	4	9	4.0	
Sacramento	71	106	117	30.14	30.22	+ .09	45.4	— 3.1	62	6	54	28	23	37	26	41	37	73	1.64	— 2.5	6	5,044	n.	36	nw.	1	19	7	5	3.6	
San Francisco	153	161	167	30.06	30.22	+ .10	50.7	— 1.6	63	30	56	39	22	45	17	46	41	73	1.22	— 3.8	5	5,021	n.	34	sw.	7	17	8	6	4.5	
Point Reyes Light	.....	12	....	.....	.....	.....	51.4	+ 1.6	71	30	58	36	20	45	22	....	....	....	1.83	— 3.5	8	.....	nw.	....	.....	...	18	8	5	....	
S. Pac. Coast Reg.							51.9	— 1.1											0.28	— 2.2											
Fresno	332	67	70	29.83	30.19	+ .05	45.0	— 1.7	64	31	56	23	21	34	35	41	37	76	0.48	— 1.0	6	2,507	nw.	23	nw.	1	20	5	6	3.3	
Los Angeles	330	74	82	29.77	30.13	+ .05	55.7	— 0.2	89	29	69	30	21	42	38	45	34	53	0.05	— 3.9	2	2,915	w.	24	nw.	2	20	9	2	2.1	
San Diego	87	59	70	30.03	30.13	+ .05	55.0	— 1.3	80	13	64	36	22	46	27	46	37	58	0.32	— 1.8	5	3,965	ne.	23	nw.	1	26	3	2	2.1	
San Luis Obispo	201	10	46	29.97	30.19	.....	51.0	.....	82	30	66	24	22	36	49	42	34	59	0.65	.....	3	3,329	n.	22	w.	1	20	10	1	2.5	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more dates. †Received too late to be considered in departures, etc.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, December, 1897.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco†	75	27	52.6	4.58	
Ashville †	69	25	45.2	7.04	T.
Bermuda†	76	27	53.2	3.65	
Birmingham†	70	25	49.3	6.32	
Bridgeport†				8.03	
Citronelle†	73	28	53.8	3.88	
Clanton †	69	27	48.8	1.05	
Daphne†	78	28	52.6	4.23	
Decatur†	66	21	43.4	8.83	T.
Demopolis				5.81	
Elba†	73	24	51.0	2.66	
Eufaula *a*†	82	27	51.2	2.20	
Evergreen	73	29	48.8	1.80	
Florence *a*†				8.27	T.
Florence *b*†	69	26	44.8	8.36	T.
Gadsden	70	25	45.7	6.56	
Greensboro†	72	26	47.3	6.05	
Hamilton	69	19	43.8	11.20	T.
Healing Springs†	78	25	50.3	6.89	
Highland Home †	72	32	52.1	2.56	
Jasper		22		12.13	
Livingston	74	26	47.8	4.43	
Lock No. 4	70	28	44.4	6.74	
Madison Station†	66	22	42.1	7.96	
Maple Grove	67	21	43.8	7.24	
Marion†	71	26	49.4	5.67	
Mount Willing†	78	32	51.8	4.01	
Newbern†	72	27	49.0	5.33	
Newburg				9.81	0.2
Newton†	78	27	52.0	2.34	
Oneonta	69	25	46.2	7.68	T.
Opelika †	72	29	49.9	3.33	
Oxanna †	66	23	43.7	6.10	T.
Pineapple	73	25	51.6	6.03	
Pushmataha †	76	28	50.4	5.17	
Riverton †	70	24	43.3	8.60	T.
Rockmills †	70	23	46.1	4.07	
Scottsboro †	66	20	43.9	7.18	T.
Selma †	79	26	48.6	4.13	
Sturdevant				6.63	
Talladega *1	70	25	47.2	5.48	T.
Tallassee				4.11	
Thomasville	73	25	49.8	4.48	
Tuscaloosa†	69	29	47.9	8.08	
Tuscumbia	68	25	44.1	8.45	
Union†	73	25	49.0	5.22	
Union Springs†	77	28	50.0	2.78	
Uniontown†	73	27	50.4	3.99	
Valleyhead	64	25	43.6	8.19	T.
Warrior				8.71	
Wetumpka	76	27	49.2	4.36	
Wilsonville †				5.62	
Arizona.					
Antelope Valley				0.40	6.0
Arizona Canal Co. Dam.	79	26	53.2	0.39	
Benson *5	79	25	58.1		
Bisbee†	67	24	45.0	0.44	3.0
Buckeye†	84	20	49.6	0.10	
Calabasas	73	18	44.4	0.00	
Casa Grande *5	58	33	43.7	0.00	
Cedar Springs	71	16	42.6	0.63	6.3
Congress	77	24	50.4	0.87	6.8
Dragoon				0.00	
Dragoon Summit *5	62	25	46.6		
Dudleyville	74	21	45.8	0.37	
Empire Ranch	64	18	40.0	0.30	3.0
Farleys Camp†	76	26	53.2	0.60	
Flagstaff †	54	−10	27.1	1.50	15.0
Fort Apache	65	9	36.1	0.57	4.8
Fort Defiance	51	− 8	34.9	1.15	11.5
Fort Grant †	69	19	44.0	0.34	
Fort Huachuca †	71	17	44.5	0.65	
Fort Mojave	75	22	48.6	0.00	
Gilabend *a* *5	84	26	51.3	0.00	
Gisela	68	18	44.2	1.03	4.2
Holbrook†	65	5	31.0	0.34	3.0
Jerome	63	19	42.7	1.17	11.7
Lochiel *1	69	20	41.6	0.18	1.5
Maricopa *5	89	28	54.7	T.	
Mesa †	76	24	47.8	0.30	
Mount Huachuca	70	19	43.2	0.39	2.0
Music Mountain	67	13	39.2	0.30	1.9
Natural Bridge				0.25	T.
Oro Blanco	74	18	44.0	0.12	T.
Pantano *5	78	30	48.5	0.25	
Parker	79	21	48.4	0.50	
Payson				1.10	8.5
Peoria †	69	23	46.8	0.26	
Phœnix	80	17	46.3	0.08	
Pinal Ranch				1.49	6.5
St. Helena Ranch				0.34	T.
San Carlos †	74	20	41.8	0.59	
San Simon *5	78	18	43.1		
Signal †	74	23	45.8	0.24	
Snowflake	59	− 1	29.8	0.53	5.8
Strawberry	63	− 4	33.3	1.22	12.5
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sulphur Spring Valley				0.07	T.
Texas Hill *5	70	27	46.1	0.00	
Tombstone	69	19	44.8	0.23	1.5
Tuba	58	1	27.6	0.25	4.0
Tucson *c*†	80	16	48.8	0.11	
Whipple Barracks†	74	− 8	33.3	0.42	3.2
White Hills	65	16	41.2	0.20	T.
Willcox *5	61	13	39.2	0.21	0.7
Williams	56	−12	30.8	0.15	1.5
Arkansas.					
Amity	72	17	41.8	6.52	0.5
Arkansas City†				6.15	
Beebranch *	81	12	39.2	4.98	8.0
Blanchard Springs†	71	21	45.3	9.11	T.
Brinkley				3.15	2.0
Camden *a*†				6.46	
Camden *b*†	74	20	43.6	6.51	
Canton *1	68	18	36.3		
Conway	74	16	40.4	6.00	10.0
Dallas	68	10	40.6	4.79	5.0
Dardanelle				2.74	7.0
Elon†	74			9.01	
Fayetteville†	73	10	37.1	5.41	1.0
Forrest	72	22	39.8	6.62	
Fulton†				5.43	
Hardy	64	18	36.6	4.85	0.8
Helena *a*†				8.31	1.0
Helena *b*	72	20	43.6	6.88	
Hot Springs *a*	78	15	42.8	5.87	1.7
Hot Springs *b*				5.64	0.4
Jonesboro	66	21	38.0		
Keesees Ferry†	68	16	37.2	5.41	0.8
Lacrosse †	59	10	32.2	4.75	1.5
Lonoke *1	69	25	40.4	6.49	6.0
Luna Landing *5	75	25	45.0	7.15	
Lutherville *1	68	19	39.6		
Malvern†	68	18	36.6	6.96	1.0
Marianna *1	70	26	42.6		
Marvell	70	24	43.2	7.30	3.0
Monticello	77	21	44.8	6.63	T.
Moore				6.43	8.3
Mossville	67	14	36.2	6.06	0.2
Mount Nebo†	63	16	37.2	6.35	9.8
New Gascony *1	76	23	41.4	7.70	1.5
Newport *a*†				6.96	5.5
Newport *b*†	70	19	37.8	6.88	7.0
Newport *c*†	70	16	39.2	6.72	6.0
Oregon *1	76	16	35.5		
Osceola	72	22	39.3	4.52	6.0
Ozark †	68	16	40.0	4.84	3.0
Picayune†	76	14	43.7	6.52	T.
Pinebluff ††	73	23	43.3	6.93	
Pocahontas†	64	17	36.0	5.44	0.1
Powell *†1	66	18	35.8	4.61	1.0
Prescott	75	19	40.4	4.60	
Rison	77	23	43.0	6.08	
Russellville	69	18	38.5	4.79	7.2
Silver Springs †	68	12	35.0	3.19	2.0
Spielerville	69	15	38.4	4.93	5.0
Stamps	82	18	46.4	4.68	
Stuttgart †.	70	22	40.9	5.74	2.5
Texarkana †.	78	20	43.0	4.45	
Warren †	73	23	46.0	6.45	
Washington *†1	76	17	43.5	6.66	
Wiggs *1	71	18	42.0	5.98	2.0
Winslow	65	10	34.6	8.10	6.0
Witts Springs †	67	12	36.1	5.27	3.0
California.					
Agnew	70	26	46.1	1.45	
Arlington Heights	86	27	51.7	0.22	
Athlone *5	63	24	44.4		
Azusa				0.27	
Ballast Point L. H				0.20	
Bear Valley				5.96	10.0
Berkeley	61	35	48.2	2.71	
Bishop†	67	10	40.9	0.49	1.0
Boca *5	54	1	24.4	2.72	15.0
Bodie†	48	−20	20.2	2.53	
Bowmans Dam *†1	66	20	38.3	5.31	13.0
Caliente *5	72	30	47.7	2.02	
Campbell	64	23	45.4	1.17	
Cape Mendocino L. H				6.10	
Castle Pinckney *1	82	37	54.6	0.00	
Cedarville†	57	7	30.5	2.31	5.0
Centerville *1	68	32	51.2	1.95	
Chico *5	69	28	48.4	2.38	
Cisco *5	44	9	28.8		
Claremont†	80	25	49.4	0.71	
Corning *5	65	27	43.0	1.60	
Craftonville	70	24	46.6	0.67	
Crescent City†	67	31	48.0	10.66	
Crescent City L. H				10.58	
Daunt				3.37	
Delano *5	63	25	44.7	0.30	
Delta *5	67	25	45.5	6.05	
Descanso *5	74	18	46.4	2.90	5.0
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Drytown	65	26	45.2	1.79	
Dunnigan *5	64	26	44.1	1.69	
Durham *1	62	27	44.9	2.15	
East Brother L. H				1.15	
Edmanton *1	56	13	34.0	5.21	18.0
Elsinore	85	24	52.3	0.19	
Escondido	81	18	45.2	0.75	
Fallbrook *1	86	30	50.8	0.38	
Fordyce Dam				7.17	19.0
Fort Bragg†				2.28	
Fort Ross	68	35	48.4	6.16	
Fort Tejon				1.72	
Georgetown	76	24	44.2	5.57	T.
Glendora				0.15	
Goshen *5	68	32	42.9	0.36	
Grand Island *5	62	27	46.0	0.96	
Grass Valley				3.52	1.0
Greenville†	55	10	34.2	3.73	2.0
Guinda				1.35	
Healdsburg *1	56	26	41.8	3.01	
Hollister	74	22	46.0	1.47	
Humboldt L. H				5.04	
Hydesville	66	28	47.0	4.11	
Indio *5	82	30	53.3	0.00	
Iowa Hill *1	67	25	42.0	5.31	
Jackson				3.18	
Jolon				0.46	
Keene *5	71	24	43.3	3.02	1.0
Kennedy Gold Mine	63	25	44.0	3.26	
Kernville				1.14	4.0
King City *5	68	30	45.3	0.32	
Kingsburg *5	60	22	42.1	0.60	
Kono Tayee	56	29	44.0	2.12	
Lagrange *5	65	28	46.8	1.38	
Laporte *†1	58	13	33.5	6.63	16.0
Lemoore *a* *5	62	18	41.3	0.24	
Lick Observatory	71	32	43.0	2.70	2.0
Limekiln	68	27	46.5		
Lime Point L. H				1.44	
Lodi	62	27	44.7	1.57	
Los Alamos				0.25	
Los Gatos *b*	60	30	46.0	1.81	
Lytton Springs	62	30	46.4	3.11	
Malakoff Mine *1	72	24	42.0	5.41	2.0
Mammoth Tank *5	75	32	53.6	T.	
Mare Island L. H				1.37	
Merced *5	68	26	44.7	0.75	
Mills College				2.90	
Milton (near) *1	64	32	49.0	1.50	
Modesto *5	75	29	47.1	0.54	
Mohave *5	70	15	42.3	0.00	
Mokelumne Hill *5		30	43.0	2.30	
Monterey *5	68	30	50.0	1.25	
Napa *b*	64	26	46.9	1.74	
Needles	72	29	49.5	0.10	
Nevada City	66	22	41.3	3.71	
Newcastle *a*	64	32	46.6		
Newhall *5	80	20	47.1		
North Ontario	86	28	52.4	0.43	
North San Juan *1	65	24	43.1	1.65	
Oakland *a*	63	32	47.5	2.49	
Ogilby *5	75	35	51.6		
Oleta *1	62	24	40.8	3.01	
Orangevale†	60	28	45.0	1.92	
Orland *5	65	27	49.0	1.41	
Oroville *b*	66	28	46.5	1.95	
Pajaro	74	34	52.9	1.50	
Palermo†	62	20	44.2	0.45	
Paso Robles *b*	69	16	43.6	0.23	
Peachland *1	63	26	45.4	4.01	
Piedras Blancas L. H				1.01	
Pigeon Point				0.90	
Pilot Creek				7.59	6.8
Pine Crest	83	30	58.4	0.00	
Placerville	62	20	39.7	2.43	
Point Ano Nuevo L. H				0.90	
Point Arena L. H				2.68	
Point Bonita L. H				2.82	
Point Conception L. H				0.23	
Point Fermin L. H				0.25	
Point Hueneme L. H				0.02	
Point Lobos	59	39	49.2	1.54	
Point Loma L. H				0.25	
Point Montara L. H				2.44	
Point Pinos L. H				1.30	
Point Reyes L. H				1.83	
Point Sur L. H				0.79	
Pomona (near)	84	26	49.8	0.96	
Poway *5	89	24	41.7	0.72	
Quincy †	53	15	33.7	3.97	1.0
Ravenna *5	88	25	46.7	0.11	
Redding *b*†	68	26	45.9	3.60	
Represa	62	24	45.1	2.04	
Rio Vista	65	24	44.2	1.24	
Roe Island L. H				0.75	
Rosewood	68	30	41.6	2.11	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sacramento *a*	61	26	45.0	1.59	
Salinas *[8]	68	25	48.2	0.82	
Salton *[8]	79	28	52.5	0.00	
San Bernardino †	83	25	50.2	0.57	
San Jacinto	82	20	46.2	0.47	
San Leandro *[1]	78	35	52.6	2.43	
San Luis L. H.	.....	.....	.....	0.75	
San Mateo *[6]	60	34	48.6	1.84	
San Miguel *[8]	66	15	43.3	0.27	
Santa Ana *[5]	87	31	60.8	0.00	
Santa Barbara *a*	84	32	54.4	0.00	
Santa Barbara L. H.	.....	.....	.....	0.04	
Santa Clara *a*	.....	.....	.....	1.29	
Santa Cruz *b* †	77	27	49.4	2.13	
Santa Cruz L. H.	.....	.....	.....	1.93	
Santa Maria	83	28	51.3	0.55	
Santa Monica *[8]	84	31	56.6	0.00	
Santa Paula	82	29	53.4	.....	
Santa Rosa *[8]	63	26	47.4	.....	
Saticoy	.....	.....	.....	0.00	
Shasta	.....	.....	.....	4.81	
Sierra Madre	81	33	54.2	0.69	
Sneddens Ranch *†	66	— 8	25.2	0.05	T.
S. E. Farallone L. H.	.....	.....	.....	1.74	
Stanford University	64	26	45.0	1.52	
Stockton *a*	61	24	43.6	1.23	
Summerdale †	61	12	36.6	4.57	14.0
Susanville †	54	16	34.4	2.22	
Sutter Creek *[5]	58	21	38.7	1.58	
Tehama *[8]	69	28	47.2	1.77	
Templeton *[8]	62	30	38.6	0.30	
Trinidad L. H.	.....	.....	.....	6.76	
Truckee *[8]	56	— 4	26.0	3.15	19.5
Tulare *b*	.....	.....	.....	0.93	
Tulare *c*	72	22	46.2	0.79	
Turlock	65	27	47.4	0.67	
Ukiah †	69	23	44.2	2.77	
Upper Mattole *[1]	.....	32	48.9	7.58	
Vacaville *[1]	66	29	46.6	2.08	
Ventura †	82	26	51.6	0.00	
Volcano Springs *[8]	81	31	52.5	T.	
Walnut Creek	64	27	47.2	1.36	
West Palmdale *[1]	65	11	41.3	0.14	T.
Westpoint	.....	.....	.....	4.64	1.0
Wheatland †	60	26	43.4	1.89	
Williams *[8]	67	28	47.3	0.85	
Wilmington *[8]	81	30	57.2	.....	
Wire Bridge *[8]	61	25	44.6	3.26	
Yerba Buena L. H.	.....	.....	.....	0.90	
Yreka †	56	18	36.8	3.76	
Yuba City *[8]	56	29	41.9	1.78	
Colorado.					
Altman	41	— 4	20.3	.....	.....
Antlers †	46	— 4	21.4	1.39	15.0
Arkins	.....	.....	.....	0.64	6.2
Boulder	65	— 1	30.6	0.70	9.0
Boxelder	.....	.....	.....	0.85	6.0
Breckenridge †	49	—31	12.2	2.25	22.5
Canyon †	.....	.....	.....	0.39	0.5
Castlerock	65[h]	—12[h]	28.2[i]	1.23[g]	12.3
Cheyenne Wells	64	—10	26.6	0.20	2.0
Collbran	.....	.....	.....	1.90	19.2
Colorado Springs †	64	— 2	27.7	0.06	1.4
Cope	63	— 3	25.6	0.45	3.0
Crook *e*	62	—13	25.8	.....	.....
Delta	52	— 4	22.0	0.25	.....
Dumont †	.....	.....	.....	0.85	8.5
Durango	50	2	25.4	1.99	19.3
Fleming	.....	.....	.....	0.60	5.0
Fort Collins †	63	—11	25.4	0.67	5.5
Fort Morgan	54	.....	.....	0.19	2.6
Fox	.....	.....	.....	0.75	5.0
Garnett	.....	.....	.....	0.32	3.8
Georgetown	60	2	26.1	.....	.....
Gleneyrie †	59	— 3	29.0	0.37	4.0
Grand Junction †	44	— 6	22.5	0.40	5.5
Greeley †	61	—10	23.3	0.38	4.0
Gulch †	46	— 5	22.4	1.00	10.0
Gunnison	48[c]	—24[c]	13.8[c]	0.30	3.0
Hoehne	65	— 1	27.6	0.29	1.0
Holly	.....	.....	.....	0.23	1.0
Holyoke	.....	.....	.....	0.30	3.0
Holyoke (near)	.....	.....	.....	0.42	4.0
Hugo	.....	.....	.....	0.60	6.0
Hugo (near)	65	— 4	23.6	0.22	3.0
Husted †	66	— 7	27.4	0.26	4.0
Lake Moraine †	47	— 3	21.4	0.70	7.0
Lamar †	67	— 1	29.8	0.14	0.8
Laporte	.....	.....	.....	0.70	7.0
Las Animas †	60	— 3	27.3	0.20	.....
Leadville (near) *†	45	—14	18.2	1.39	14.6
Leroy †	56	— 8	24.6	0.81	7.2
Longs Peak	48	— 9	22.6	0.55	5.5
Loveland	.....	.....	.....	0.63	6.0
Manitou Park	55	— 5	23.7	0.88	8.0
Meeker †	47	—30	13.1	2.19	27.7
Colorado—Cont'd.					
Millbrook	61	—23	20.6	1.85	18.5
Minneapolis †	71	— 1	32.0	0.10	1.0
Moraine †	47	— 6	24.4	1.20	14.0
Pagoda †	47	—28	14.9	3.03	30.0
Paonia †	.....	.....	.....	0.55	5.5
Parachute †	44	0	20.1	.....	.....
Pinkhamton	.....	.....	.....	2.00	20.0
Rangely †	47	—30	7.9	0.88	9.7
Redcliff	.....	.....	.....	1.78	17.8
Rico	46	—12	20.6	2.02	20.2
Rockyford	74	— 8	26.7	1.06	6.8
Ruby	.....	.....	.....	5.75	57.5
Saguache †	53	—11	18.8	0.40	4.0
Salida	57	—10	26.4	0.77	7.8
San Luis †	54	—25	18.8	1.40	14.5
Santa Clara *[1]	61	— 5	25.9	1.80	18.0
Selbert †	.....	.....	.....	0.65	6.0
Smoky Hill Mine	66	— 6	26.4	0.70	7.0
Springfield	.....	.....	.....	0.11	1.1
Stamford *[1]	58	—10	19.8	2.00	20.0
Steamboat Springs	61	—33	15.9	2.70	27.0
Strickler Tunnel	.....	.....	.....	0.50	8.0
Surface Creek †	60	— 8	25.0	1.02	9.5
T. S. Ranch †	54	0	23.2	0.54	5.8
Twin Lakes	.....	.....	.....	0.45	3.0
Vilas	.....	.....	.....	0.05	.....
Walden [d]	42	—23	12.8	0.50	5.0
Wallet	.....	.....	.....	0.50	5.0
Wray †	62	— 8	26.7	0.31	2.5
Yuma	.....	.....	.....	1.00	10.0
Connecticut.					
Canton †	58	— 1	29.4	5.71	11.0
Colchester	59	5	31.8	5.55	7.0
Middletown	60	2	32.7	5.85	3.5
New London †	54	7	31.6	4.55	8.1
Norwalk	59	— 1	31.8	5.49	5.5
Southington *[1]	58	— 3	30.7	6.35	7.0
Storrs	59	3	30.7	5.61	6.0
Voluntown †	57	1	33.4	6.31	5.0
Waterbury	60	1	33.4	5.99	9.0
West Cornwall †	55	3	29.6	4.53	13.0
Windsor	55	1	29.4	6.26	9.3
Delaware.					
Milford	71	16	41.3	3.85	T.
Millsboro	68	12	40.0	3.83	
Newark	61	13	35.4	3.78	1.5
Seaford	66	15	39.1	3.87	.....
District of Columbia.					
Distributing Reservoir *[5]	65	14	38.2	3.37	.....
Receiving Reservoir *[5]	64	13	37.6	3.45	.....
West Washington	70	13	37.7	3.68	0.5
Florida.					
Archer †	85	31	58.6	5.07	
Bartow	85	31	61.8	2.62	
Boca Raton †	85	49	70.6	1.74	
Brooksville †	81	38	60.2	2.08	
Carrabelle †	74	36	56.1	6.50	
Clermont †	.....	.....	.....	2.52	
De Funiak Springs	75	28	52.0	3.15	
Earnestville	82	38	61.4	2.89	
Estero *[1]	80	43	64.6	.....	
Eustis †	84	38	61.4	1.72	
Federal Point †	79	35	58.6	3.71	
Fort Meade †	86	35	59.1	1.68	
Frostproof	86	41	65.7	1.07	
Gainesville	81	36	57.2	4.35	
Grasmere †	80	35	61.2	2.55	
Haywood	79	33	55.7	2.88	
Huntington	81	38	60.1	2.69	
Kissimmee	.....	37	.....	2.94	
Lake Butler	82	32	55.4	1.98	
Lake City †	82	34	59.6	4.10	
Lemon City	91	52	70.4	1.00	
Macclenny †	81	32	57.4	3.25	
Manatee	84	34	62.4	2.60	
Merritts Island	80	47	65.2	2.18	
Mullet Key †	78	46	63.2	2.02	
Myers †	82	43	65.1	1.06	
New Smyrna	82	35	61.2	2.19	
Oakhill *[1]	84	46	66.0	.....	
Ocala †	84	32	60.5	3.08	
Orange City	84	32	61.1	2.21	
Orange Park	78	32	57.0	3.54	
Orlando †	.....	36	.....	2.62	
Oxford *† [1]	82	34	60.3	1.20	
Perry [c]	81	28	55.9	4.24	
Plant City	86	32	62.6	2.24	
St. Francis †	84	32	60.8	1.86	
St. Francis Barracks	78	36	58.7	2.50	
Sebastian	85	42	66.5	2.27	
Tallahassee †	75	34	54.5	5.27	
Tarpon Springs †	82	33	59.4	2.48	
Wausau	78	28	52.8	2.28	
Georgia.					
Adairsville †	67	26	43.2	6.21	
Alapaha	75	28	51.6	3.33	
Georgia—Cont'd.					
Albany †	77	29	54.2	2.59	
Allentown †	73	28	50.6	1.86	
Americus †	75	29	51.4	2.60	
Athens †	68	28	44.0	2.83	
Belleville	78	27	52.7	2.57	
Blakely †	74	31	53.4	3.20	
Brag	84	27	53.0	2.39	
Canton †	.....	.....	.....	5.20	
Clayton †	61	20	41.4	6.00	
Columbus	74	30	51.4	3.13	
Covington	63	32	42.4	3.07	
Crescent	80	32	55.5	3.24	
Dahlonega †	66	23	43.2	6.08	T.
Diamond	67	20	41.9	7.97	T.
Elberton †	68	22	43.0	3.35	
Fleming †	75	26	52.6	2.75	
Franklin	70	28[c]	50.1[d]	4.31	
Gainesville	65	25	43.7	2.78	
Gillsville †	65	25	45.4	3.91	
Greenbush	68	23	42.9	7.69	T.
Hawkinsville	74	19	47.3	2.58	
Hephzibah *† [6]	72	34	52.0	1.60	
Jesup	76	29	52.4	2.54	
Lagrange †	71	25	50.5	1.75	
Louisville	75	28	49.6	0.62	
Lumpkin	73	31	52.2	1.97	
Marietta	68	26	43.8	3.91	
Marshallville †	74	31	51.4	2.83	
Millen [g]	79	26	51.6	1.56	
Morgan †	76	25	50.4	2.89	
Mount Vernon	75	32	52.6	2.60	
Newnan †	63	29	42.4	3.37	
Piscola	77	32	55.4	4.05	
Point Peter	68	22	43.8	3.05	
Poulan †	79	25	52.6	2.11	
Quitman †	81	27	54.4	3.80	
Ramsey	69	23	46.0	6.50	T.
Resaca	.....	.....	.....	7.16	
Reynolds	.....	.....	.....	2.14	
Rome †	69	27	44.1	6.83	
Talbotton †	74	30	49.2	1.51	
Tallapoosa	68	19	44.6	5.07	
Thomasville †	77	31	54.4	3.26	
Toccoa †	65	18	44.8	4.44	
Washington †	.....	.....	.....	1.55	
Waycross	75	31	52.6	3.00	
Whitesburg †	.....	.....	.....	4.27	
Idaho.					
American Falls	46	— 9	25.9	1.57	.....
Blackfoot †	42	— 9	22.6	0.96	3.1
Boise Barracks †	53	12	32.6	2.30	4.2
Burnside †	42	—11	19.6	0.93	7.2
Cœur d'Alene	50	8	30.2	.....	.....
Corral *[1]	41	—12	17.6	3.00	30.0
Downey	40	—16	19.8	0.60	6.0
Fort Sherman †	50	6	29.6	4.55	7.9
Gimlet †	39	—13	17.8	1.95	19.5
Gray	45	—27	20.4	2.10	21.0
Idaho City †	57[c]	— 4[c]	26.4[c]	4.10	16.8
Kootenai †	47	— 8	25.8	5.34	35.0
Lake	30	—16	10.4	1.50	15.0
Lakeview	48	8	30.5	4.96	4.0
Lewiston	55	.....	.....	1.37	1.5
Lost River	.....	.....	.....	0.73	7.4
Marysville	43[f]	—16	18.3[c]	3.60	30.0
Minidoka	49	— 8	22.4	0.85	8.5
Moscow	48	6	29.8	2.56	3.5
Murray †	47	— 3	26.6	5.27	26.0
Nampa	49	9	30.5	2.25	.....
Oakley	48	5	28.2	1.00	7.0
Ola †	47	1	28.3	4.49	12.5
Paris	46	14	17.4	0.76	.....
Payette †	50	14	32.8	2.62	4.8
Pollock †	56	14	36.2	0.87	T.
Rexburg	44	—22	18.6	.....	.....
St. Maries	48	10	31.4	6.49	7.3
Salubria	50	— 4	28.4	3.77	18.2
Soldier †	43	—25	17.9	2.76	25.3
Swan Valley †	46	—22	19.2	1.66	16.5
Warren †	48	—18	26.8	1.32	.....
Illinois.					
Albion †	72	10	33.6	4.60	4.5
Alexander †	59	— 2	27.6	2.42	5.5
Ashton *† [1]	54	—12	21.1	1.30	7.7
Atwood *† [9]	.....	2	26.3	4.22	.....
Aurora *a*	54	— 9	23.4	1.32	2.7
Aurora *b*	53	— 8	22.8	1.67	7.0
Bloomington †	56	— 6	25.4	2.00	4.0
Bushnell †	57	— 6	25.0	1.69	4.0
Cambridge	57	— 3	23.8	1.61	10.4
Carlinville †	61	5	30.0	2.89	1.0
Carlyle	.....	.....	.....	2.75	.....
Carrollton	60	7	27.6	1.94	6.0
Charleston	61	6	30.0	3.05	3.4
Chemung	48	— 12	19.1	1.40	11.8
Chester	.....	.....	.....	4.77	2.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cisne†	66	9	32.8	3.90	2.8
Clearcreek†	57	−12	22.8	1.03	4.5
Coatsburg	57	− 5	24.3	2.26	.....
Cobden†	66	13	34.6	5.15	T.
Cordova	.....	.....	.....	1.47	.....
Danville	59	2	29.2	2.43	1.0
Decatur†	60	2	28.4	2.54	1.5
Dixon†	57	−10	22.0	1.17	7.0
Dwight†	54	− 6	24.1	1.59	5.0
East Peoria†	58	−13	25.1	1.43	3.6
Effingham†	63	7	31.6	3.14	6.1
Elgin	53	− 8	22.5	.....	9.5
Fort Sheridan†	55	− 1	23.6	1.51	6.3
Friendgrove†	.....	.....	.....	4.49	4.3
Galva†	55	−10	22.2	1.08	6.3
Glenwood *†[1]	56[c]	− 7	24.6[c]	1.62	3.0
Golconda†	70	13	36.4	3.38	.....
Grafton†	.....	.....	.....	2.72	2.5
Grayville	68	14	37.5	4.79	3.0
Greenville†	59	7	30.2	3.96	4.7
Griggsville†	61	− 1	26.6	2.34	.....
Halliday *[b]	66	12	34.6	3.38	.....
Havana†	58	0	27.9	1.82	5.0
Herrin	66[d]	6[c]	34.6[d]	2.92	.....
Hillsboro†	62	6	29.8	2.82	4.0
Iron	68	12	35.5	2.91	0.5
Joliet†	56	− 6	25.6	1.68	4.2
Jordans Grove†	64	11	33.8	4.13	1.7
Kankakee *a†	55	− 5	25.8	.....	.....
Kishwaukee	55	−12	19.4	1.79	9.0
Knoxville *a	55	− 5	24.0	1.47	5.0
Lagrange†	55	− 7	23.7	1.36	2.5
Laharpe *[1]	56	− 4	23.8	2.10	8.8
Lanark†	47	−15	19.0	1.46	4.5
Lexington	58	6[c]	26.5[c]	1.47	4.5
Loami†	.....	.....	.....	2.73	2.2
Louisville†	64	9	32.8	2.95	3.3
McLeansboro†	67	12	34.8	5.12	0.5
Martinsville†	65	7	31.5	2.83	4.0
Martinton†	55	− 8	25.0	2.20	3.5
Mascoutah *[b]	62	10	34.0	2.73	5.2
Mattoon *[1]	58	1	27.7	2.65	6.9
Minonk†	57	− 9	24.2	1.20	6.5
Monmouth†	55	− 8	25.6	1.69	7.6
Morrisonville†	61	5	29.0	2.78	2.2
Mount Carmel†	.....	.....	.....	4.88	8.0
Mount Pulaski	58	− 2	27.4	2.35	4.5
Mount Vernon	.....	.....	.....	1.89	.....
New Burnside†	70	11	36.2	2.71	T.
Olney *a*	66	8	33.7	3.86	4.8
Oswego *[1]	51	− 8	21.7	1.58	3.0
Ottawa†	57	− 6	24.8	1.74	3.5
Palestine†	66	7	33.6	3.18	4.6
Paris	61[c]	5[c]	31.0[c]	2.93	.....
Peoria *a*†	.....	.....	.....	1.32	.....
Peoria *b*†	59	− 1	27.4	1.16	5.5
Philo†	60	2	23.6	2.65	.....
Plumhill†	64	12	32.9	3.69	.....
Rantoul†	57	− 4	26.8	2.32	5.7
Reynolds	54	− 6	21.4	1.42	10.0
Riley†	51	−11	20.2	1.50	6.2
Robinson†	66	6	31.7	4.35	0.8
Rockford	50	−10	19.5	1.62	11.0
Roundgrove†	55	−10	21.8	1.32	11.8
St. Charles *†[1]	53	− 8	23.2	1.48	4.5
St. John *†[1]	65	13	33.1	4.16	.....
Scales Mound	48	−18	18.0	1.66	9.6
Streator†	55	− 2	25.4	1.32	3.5
Sycamore†	52	−11	21.0	0.81	4.1
Tiskilwa †	54	− 6	22.8	1.24	6.6
Tuscola†	61	3	29.2	3.33	1.5
Walnut†	59	− 9	25.4	1.31	4.8
Wheaton *[3]	.....	− 4	21.8	0.99	5.5
Winchester *[1]	56	2	26.7	2.89	2.8
Winnebago†	55	− 9	20.4	1.58	10.0
Zion†	50	−13	19.0	2.68	6.6
Indiana.					
Anderson†	61	4	30.9	2.38	2.2
Angola *[1]	54	1	28.2	2.95	6.2
Auburn	57[c]	− 5[c]	28.2[c]	1.93	.....
Bloomington†	64	6	32.3	3.24	5.0
Bluffton†	60	− 2	28.7	1.87	4.5
Boonville	70	14	37.6	3.10	1.5
Bright†	65	7	34.7	2.86	6.4
Butlerville†	67	5	34.2	3.64	4.9
Cambridge City†	64	3	32.0	2.67	6.0
Columbia City *[1]	57	− 3	28.3	2.35	4.0
Columbus†	67	4	32.5	3.76	4.0
Connersville†	64	4	31.1	2.86	7.7
Crawfordsville	61	5	33.1	.....	.....
Delphi†	61	− 3	27.5	2.64	3.0
Edwardsville *†[1]	69	10	36.8	3.00	6.8
Farmland†	62	5	31.2	1.72	3.8
Fort Wayne	61	1	29.6	2.25	4.5
Franklin *[1]	64	10	33.0	3.32	8.0
Greencastle†	66	1	31.2	3.97	4.6
Hammond†	56	− 7	25.9	0.62	3.0
Hector	58	3	29.8	1.24	1.5
Huntington	60	2	28.5	2.91	9.0
Jasper†	66	11	35.5	3.65	3.0
Jeffersonville	67	13	37.4	2.84	2.0
Knightstown†	64	5	31.4	2.80	5.5
Kokomo†	59	3	30.2	2.46	4.0
Lafayette†	61	− 1	28.8	2.26	1.2
Laporte	55	3	29.3	3.55	12.4
Logansport *b*†	58	− 2	27.1	1.61	5.8
Madison	69	10	36.5	2.48	1.5
Marengo†	67	10	36.5	3.02	5.2
Marion†	60	2	30.0	1.85	2.8
Markle	58	.....	.....	0.50	4.0
Mauzy†	64	5	31.6	3.24	9.1
Michigan City *[10]	55	6	27.7	.....	.....
Mount Vernon†	69	14	35.9	3.23	T.
Northfield †	59	3	30.0	2.25	3.0
Princeton *[1]	65	15	35.3	1.13	5.5
Richmond	64	5	32.3	2.42	2.5
Rockport	68	15	38.3	2.96	3.0
Rockville†	61	4	29.5	4.37	2.0
Salem	68	10	33.0	2.17	3.0
Scottsburg	68	10	36.6	2.44	2.5
Shelbyville	65	8	32.6	2.59	4.0
South Bend†	58	− 2	26.6	3.50	22.0
Syracuse†	.....	.....	.....	2.30	7.0
Terre Haute†	63	9	32.0	3.97	0.8
Topeka†	56	− 9	28.0	.....	5.0
Valparaiso†	56	− 4	25.4	0.61	6.0
Vevay	70	10	37.0	2.00	1.0
Warsaw†	55	− 5	25.8	1.42	T.
Washington†	70	10	36.0	3.75	2.0
Winamac	58	0	25.7	.....	.....
Worthington†	66	7	33.5	4.29	5.6
Indian Territory.					
Healdton†	76	9	39.0	1.95	5.0
Kemp†	74	12	41.7	0.20	2.0
Lehigh†	78	11	39.8	4.27	5.0
Purcell†	74	5	38.9	0.03	0.3
South McAlester†	.....	.....	.....	5.22	5.5
Tahlequah	72	10	38.0	1.05	T.
Tulsa†	.....	.....	.....	1.08	.....
Wagoner	76	15	37.4	1.30	.....
Iowa.					
Adair	.....	.....	.....	0.95	9.5
Afton	50	−12	20.2	2.33	21.0
Albia	50	−11	21.0	1.38	12.5
Algona *[1]	42	−14	15.2	1.60	16.2
Alta *a*†	42	−12	15.8	1.52	16.7
Amana†	45	−14	18.2	1.72	15.7
Ames *b*.	42	−15	15.4	.....	.....
Ames (near)	.....	.....	.....	1.56	15.6
Atlantic†	45	−25	18.0	1.50	15.0
Audubon	46	−13	17.2	1.70	17.0
Belknap	50	− 6	20.2	2.25	19.0
Belleplaine	50	−16	15.8	2.20	22.0
Bonaparte†	50	− 8	21.3	1.97	13.0
Britt	44	−16	13.4	1.10	10.7
Burlington	53	− 1	24.4	0.61	.....
Carroll	43	−16	16.0	1.71	17.2
Cedarfalls	48	−14	16.0	1.80	18.0
Cedar Rapids†	47	−14	17.0	1.02	17.0
Chariton	47	− 9	21.4	2.13	19.5
Charles City	43	−15	13.0	1.65	16.5
Clarinda†	48	−16	21.7	1.56	17.2
Clinton	54	− 7	21.8	1.46	3.0
College Springs	50	−10	21.4	1.20	12.0
Corning†	52	−13	21.2	1.15	11.5
Council Bluffs	46	−16	20.2	1.23	13.5
Cresco†	43	−17	12.4	0.89	8.7
Decorah†	47	−15	14.2	1.19	13.0
Delaware *[3]	.....	−14	14.4	1.24	9.5
Denison†	60	−18	17.0	1.30	13.0
De Soto	48	−18	17.4	1.44	15.3
Dows	43	−19	14.6	1.57	15.0
Eldora	48	−21	15.4	2.10	21.0
Elkader†	47	−18	15.7	1.54	14.0
Estherville	45	−13	15.2	1.05	10.5
Fairfield †	57	−10	21.0	1.12	8.0
Fayette†	43	−14	15.2	1.50	14.5
Forest City	41	−17	13.6	1.56	18.0
Fort Madison *†[1]	55	2	25.9	3.12	7.0
Galva	43	−19	17.0	.....	.....
Gardengrove	46	−12	19.0	2.21	17.0
Glenwood†	48	−19	22.8	1.70	17.0
Grand Meadow *[1]	40	−10	15.6	1.27	12.8
Greene	41	−18	14.8	0.95	10.0
Greenfield	50	−12	19.3	1.40	14.5
Grinnell	42	−14	18.6	1.14	11.4
Grundy Center	42	−15	19.6	1.91	19.0
Guthrie Center	51	−16	18.1	1.61	16.7
Hampton	42	−13	14.0	1.19	15.0
Hawkeye	.....	.....	.....	1.35	13.5
Hedrick *[1]	43[d]	− 6	19.2[d]	1.44	.....
Hopeville†	45	−10	19.2	1.82	.....
Humboldt†	42	−18	16.4	0.84	18.0
Independence†	40	−17	14.2	1.93	17.2
Indianola †	.....	−15	.....	2.26	21.5
Iowa City *a*	49	−10	19.1	2.48	17.0
Iowa City *b*.	49	−10	17.0	.....	.....
Iowa Falls†	43	−18	13.6	2.00	20.0
Keosauqua	53	− 8	23.3	1.28	10.0
Knoxville	49	− 9	20.4	2.15	22.0
Lamoni *[g]	44	− 8	18.4	1.29	12.9
Lansing	46	−13	18.2	1.22	13.4
Larchwood	.....	.....	.....	1.30	13.0
Larrabee†	43	−17	16.6	1.88	18.6
Leclaire	.....	.....	.....	1.51	6.5
Lemars	42	−19	17.2	2.40	26.0
Lenox *[1]	50	− 8	20.5	2.00	17.0
Logan†	49	−21	18.4	2.93	28.0
Malvern	.....	.....	.....	1.12	14.2
Maquoketa	48	−13	22.5	1.01	14.2
Marshall†	45	−15	16.8	1.75	18.6
Mason City	40	−15	14.3	.....	.....
Millman	.....	.....	.....	1.77	17.8
Monticello	48	−15	17.1	2.63	15.5
Mooar	56	− 5	22.1	2.62	.....
Mountayr†	47	− 9	20.6	2.53	21.8
Mount Pleasant *[1]	60	− 2	23.5	1.27	11.9
Mount Vernon *a*[1]	47	−13	18.6	2.05	.....
Mount Vernon *b*.	46	−12	17.2	2.33	17.0
Newton†	42	−12	16.6	2.03	22.0
North McGregor	.....	.....	.....	1.67	21.0
Northwood	41	−14	14.1	1.20	12.0
Odebolt	47	−15	18.3	1.70	23.9
Ogden	44	−22	16.8	1.54	22.5
Osage *[3]	.....	−14	13.6	1.45	14.6
Osceola	48	−11	20.9	2.57	22.8
Oskaloosa†	48	−14	19.0	1.42	14.2
Ottumwa	55	− 8	20.4	1.92	16.5
Ovid†	45	−11	19.2	3.22	19.5
Plover	55	−14	18.2	1.45	14.5
Primghar	41	−14	16.6	1.26	12.6
Red Oak	45	−17	20.4	1.53	18.5
Rock Rapids	45	−24	14.5	0.80	8.0
Rockwell City	40	−24	13.8	2.20	22.0
Ruthven	44	−14	17.2	1.55	15.5
Sac City†	42	−19	15.8	1.78	17.4
Sibley	41	−18	14.6	1.05	10.5
Sidney	48	−12	19.8	1.94	17.0
Sigourney	48	− 9	20.0	2.61	20.5
Spencer	43	−15	16.0	0.93	3.5
Spirit Lake†	47	−15	14.9	1.30	13.0
Stuart	45	−11	17.2	0.35	3.5
Tara	47	− 8	18.5	1.15	11.4
Thurman	48	−19	19.6	1.61	23.0
Toledo	42	−17	16.4	1.79	23.5
Villisca†	47	−19	19.3	1.32	13.0
Vinton *[1]	42	−12	17.1	1.55	15.5
Washington	50	−10	18.2	1.53	15.3
Washta	.....	.....	.....	1.60	18.0
Waterloo	42	−14	15.2	1.52	16.0
Waverly	42	−14	15.8	1.64	17.5
Webster City	42	−15	17.0	1.44	18.0
Westbend *†[1]	41[c]	−15	13.2	1.50	15.0
West Branch	49	−12	18.4	1.54	8.6
Whitten *[1]	40	−16	14.9	1.71	14.6
Wilton Junction†	52	− 9	20.6	1.63	11.0
Winterset†	49	−13	18.4	1.80	18.0
Kansas.					
Abilene†	60	3	28.2	0.95	4.5
Achilles	.....	.....	.....	0.79	7.5
Altoona *†[3]	68	11	28.6	1.35	6.5
Anthony	.....	.....	.....	0.65	1.5
Assaria *[b]	63	8	29.2	0.57	5.2
Atchison †	59	0	26.2	1.74	13.0
Augusta	62	6	31.0	1.22	.....
Beloit†	60	0	28.2	0.39	4.0
Burlington†	68	7	31.3	1.36	2.0
Campbell	55	− 2	24.8	0.90	13.5
Colby†	70	−14	26.7	0.47	5.0
Columbus	70	10	32.2	1.61	7.0
Coolidge†	79	− 1	29.2	0.15	1.0
Cunningham†	62	− 1	29.6	0.55	4.5
Dresden	62	− 8	27.8	0.80	8.0
Ellinwood†	65	− 1	29.5	0.34	4.9
Emporia	68[d]	7[c]	27.4[c]	1.05	4.0
Englewood†	72	− 2	31.2	0.18	2.5
Eskridge	70	2	27.4	0.73	7.5
Eureka	.....	.....	.....	0.69	.....
Eureka Ranch†	68	− 7	28.2	0.27	2.7
Fallriver	70	8	30.2	0.18	0.1
Fort Riley †	63	1	27.6	0.88	8.8
Fort Scott†.	70	8	30.6	3.06	8.5
Frankfort	60	− 6	26.2	1.45	13.0
Garden City†	65	− 5	29.0	0.50	3.5
Garfield	.....	.....	.....	0.34	3.6
Gibson	66	− 4	30.5	0.40	4.0
Gove *†[1]	61	− 3	29.2	0.30	3.0
Grainfield *[8]	70	1	30.9	0.30	3.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grenola	64	8	31.6	1.15	1.5
Halstead	54	— 2	26.5	0.87	9.0
Hays	69	.....	.....	0.30	3.0
Horton	57	— 6	25.4	1.35	12.0
Hoxie	83	— 6	26.9	0.35	3.5
Hutchinson	67	6	34.3	1.17	6.8
Independence	70	11	32.8	1.51	4.5
Lakin †	65*	— 7	29.8[c]	0.10	1.0
Lawrence	67	4	28.7	1.06	9.2
Lebo †	65	4	28.9	1.45	5.0
McPherson	60	3	27.9	0.19	1.9
Manhattan *b*	62	3	27.4	1.28	10.0
Manhattan *c*	65	2	27.8	1.20	10.0
Marion †	57	5	30.0	0.80	7.0
Meade †	70	— 1	36.2	T.	T.
Medicine Lodge †	63	2	32.4	0.52	4.8
Minneapolis †	60	1	27.6	0.75	7.5
Morantown †	68	8	30.7	1.54	5.7
Morland	67	—11	28.0	0.70	7.0
Mounthope *[1]	58	3	30.8	.....	.....
Ness City	63	0	32.4	0.35	2.5
Newton	61	3	31.4	0.84	.....
Norton	60	—14	26.8	0.90	9.0
Oberlin †	.....	.....	.....	1.80	13.0
Olathe †	67	0	28.0	.....	.....
Osage City †	66	3	29.5	1.08	7.4
Osborne	.....	.....	.....	0.25	2.5
Oswego	70	11	35.2	1.30	0.7
Ottawa	67	4	29.4	1.20	6.2
Paola	68	5	29.0	2.09	5.5
Phillipsburg	66	—16	27.8	0.90	9.0
Pleasant Dale	62	1	28.7	0.28	2.0
Pratt	62	1	35.8	0.55	7.0
Rome *† [1]	60	8	31.0	0.43	3.0
Russell	66	.....	.....	0.37	4.5
Salina †	61	3	28.0	0.79	7.0
Sedan †	70	10	31.6	0.94	2.0
Seneca	58	— 8	24.8	1.45	14.5
Sharon Springs *[1]	72	0	29.1	0.30	3.0
Toronto	68	7	30.8	1.06	2.8
Ulysses †	68	—10	28.2	0.50	4.0
Viroqua †	68	— 9	30.4	0.45	3.0
Wallace *[1]	60	0	27.5	0.36	3.0
Wamego *[1]	60	2	25.5	.....	.....
Kentucky.					
Alpha	.....	.....	.....	5.21	2.0
Ashland	69	10	38.1	.....	1.0
Bardstown †	.....	10	.....	3.64	.....
Blandville †	68	15	36.1	3.61	T.
Bowling Green *a* *[1]	68	13	37.5	3.80	.....
Bowling Green *b* †	68	16	39.6	3.76	1.0
Burnside †	.....	.....	.....	4.94	1.4
Canton *† [1]	70	19	39.2	3.13	0.5
Carrollton †	70	14	38.1	2.99	1.6
Catlettsburg *† [1]	64	10	38.1	3.83	2.0
Earlington *[1]	68	18	36.9	3.91	1.5
Edmonton †	67	15	40.4	3.80	2.3
Ensor	68	13	37.2	3.28	T.
Eubank	68	10	39.0	3.59	4.0
Falmouth †	.....	.....	.....	3.29	1.0
Fords Ferry	70	15	37.0	3.01	T.
Frankfort †	67	8	38.0	.....	.....
Georgetown	67	6	38.3	.....	.....
Greensburg †	70	13	39.6	3.78	1.7
Henderson †	72	16	38.2	3.05	0.5
Hopkinsville †	69	17	39.2	3.57	2.0
Irvington	68	10	37.6	2.74	2.5
Leitchfield †	67	12	35.8	3.48	3.0
Loretto	70	7	38.6	4.23	6.0
Marrowbone †	69	13	37.4	3.87	4.5
Middlesboro †	66	12	39.0	5.27	2.2
Mount Hermon	66	13	40.1	4.08	1.0
Mount Sterling †	64	3	37.2	5.59	7.0
Owensboro †	70	10	36.4	3.40	.....
Owenton †	65	9	36.1	3.74	8.0
Paducah *a* †	.....	.....	.....	3.66	0.9
Paducah *b* †	70	18	38.4	3.49	0.7
Pleasure Ridge Park †	69	11	36.9	3.76	4.0
Princeton †	71	15	37.2	3.19	T.
Richmond †	69	8	39.4	4.15	4.5
Russellville †	68	15	40.0	3.55	T.
St. John †	68	10	35.0	3.62	2.3
Sandyhook	.....	.....	.....	3.58	0.6
Scott	65	10	36.1	2.47	4.6
Shelby City	67	9	37.8	4.17	2.0
Shelbyville †	68	8	36.5	3.53	3.2
Southfork [2]	.....	.....	37.5	4.49	4.0
Vanceburg	63	9	36.6	.....	.....
Williamsburg †	70	13	40.0	5.60	T.
Louisiana.					
Abbeville	78	30	54.5	5.75	
Alexandria †	74	23	48.5	13.59	
Amite †	80	26	54.1	6.49	
Bastrop †	79	24	48.7	8.82	
Baton Rouge †	81	28	54.2	7.06	
Cheneyville †	77	23	48.2	3.54	
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Clinton †	76	27	52.2	4.35	
Donaldsonville †	82	28	56.0	8.03	
Emilie †	77	28	54.0	5.47	
Farmerville	71	23	45.4	8.56	
Franklin †	78	30	54.6	8.25	
Grand Coteau	74	30	53.4	4.82	
Hammond	78	28	54.8	10.81	
Houma	81	29	56.8	6.26	
Jeanerette	80	25	55.4	7.00	
Jennings	77	26	54.8	6.22	
Lafayette †	77	26	53.6	3.39	
Lake Charles †	79	26	52.9	6.87	
Lawrence	79	34	58.0	5.64	
Liberty Hill	79	19	47.3	10.17	T.
Melville	75	28	52.4	4.90	
Minden [d]	75	19	46.5	7.05	
Monroe †	76	23	47.2	10.92	
New Iberia	73	30	53.0	8.35	
Oakridge †	77	28	50.1	12.39	
Opelousas	80	25	53.4	6.08	
Oxford †	78	19	46.6	8.62	T.
Paincourtville †	80	28	56.6	7.02	
Plain Dealing †	73	17	45.2	6.56	
Plaquemine	80	28	55.0	3.61	
Rayne [d]	80	33	53.4	3.13	
Robeline	76	20	46.8	14.60	
Ruston	75	22	47.2	9.46	
Schriever	83	28	55.5	6.92	
Shellbeach	73	30	57.6	.....	
Southern University †	78	30	54.8	6.85	
Sugar Ex. Station †	78	33	55.1	5.74	
Sugartown †	75	27	51.7	7.76	
Venice †	78	35	59.8	3.73	
Wallace	81	31	56.5	6.44	
Whitehall	77[h]	28	49.6[f]	9.00	
White Sulphur Springs.	79	23	52.8	12.93	
Maine.					
Bar Harbor	66	2	28.0	4.35	11.5
Belfast *°	51	2	25.4	3.50	13.0
Cornish *[1]	57	— 1	25.4	5.13	14.5
Fairfield	52	—13	22.4	3.06	9.8
Flagstaff °	53	—14	19.8	2.53	11.5
Fort Fairfield	46	— 9	17.0	2.93	17.0
Gardiner	53	— 8	24.0	3.83	14.8
Kineo †	48	— 6	20.2	2.25	6.0
Lewiston	54	— 2	25.5	4.65	15.5
Mayfield	45	— 4	20.1	3.43	15.0
North Bridgton	54	0	25.4	4.76	14.0
Orono	54	—11	23.2	3.58	12.8
Maryland.					
Annapolis	64	18	41.0	3.48	.....
Bachmans Valley	64	6	33.8	3.59	4.9
Boettcherville	65	8	35.6	3.30	1.0
Charlotte Hall †	70	14	41.4	2.98	T.
Cherryfields † [2]	.....	.....	39.4	2.78	T.
Cumberland *b*	60	15	39.5	3.30	0.5
Darlington †	61	13	35.7	2.48	3.0
Deerpark	59	— 4	31.7	4.93	6.0
Easton †	65	15	37.6	4.12	T.
Ellicott City	66	10	36.0	3.66	0.5
Fallston	62	12	35.8	3.67	3.0
Flintstone	66	5	34.8	3.20	2.0
Frederick	66°	12	36.8	3.74	4.3
Grantsville	62	1	32.2	4.11	7.0
Greatfalls	66	10	36.8	2.36	.....
Greenspring Furnace	67	8	36.4	2.86	3.3
Hagerstown †	66	.....	.....	3.45	.....
Jewell †	66	13	38.8	3.32	T.
Johns Hopkins Hospital	66	14	37.8	3.67	.....
Laurel	62	10	35.9	3.75	.....
Mardela Springs †	66	13	40.0	3.92	1.8
Mount St. Marys Coll. †	64	10	34.2	3.12	1.0
New Market	65	12	36.4	3.31	0.8
Pocomoke City	74	16	45.4	4.25	.....
Port Deposit	64	.....	.....	4.50	3.0
Princess Anne	66	13	39.4	3.09	0.2
Sharpsburg	67	10	35.3	3.23	4.0
Smithsburg	63	11	34.2	3.60	3.5
Solomons †	64	16	40.0	3.31	1.2
Sunnyside	60	0	30.6	6.38	7.0
Taneytown †	65	12	35.2	4.13	1.2
Van Bibber	59	12	36.0	4.07	.....
Western Port	64	7	34.0	1.96	1.8
Westminster	66	10	37.8	3.17	2.5
Woodstock	66	12	36.8	4.17	2.2
Massachusetts.					
Amherst	59	— 2	30.0	6.98	10.0
Bluehill (summit)	59	5	30.5	4.17	5.0
Cambridge *a*	63	2	32.0	.....	.....
Chestnut Hill	62	— 1	31.8	4.50	5.2
Concord	61	— 8	30.0	4.34	9.2
Fallriver	56	10	34.0	4.43	2.8
Fitchburg	59	3	29.6	5.70	12.5
Framingham	60	— 3	31.8	5.06	.....
Groton	59	— 1	28.6	6.03	12.5
Hyannis *† [1]	53	10	35.0	3.52	3.1
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lawrence	60	0	30.8	3.72	10.2
Lowell *a*	58	— 2	29.8	5.32	.....
Middleboro	59	4	32.3	3.49	2.2
Monson	59	— 2	31.2	5.70	10.8
New Bedford *a*	59	10	35.1	4.36	5.0
Springfield Armory	63	0	31.0	5.10	8.2
Taunton *b*	57	2	31.3	4.79	3.0
Westboro †	59	— 5	31.0	5.29	9.8
Worcester *b*	58	6	31.4	6.04	9.0
Michigan.					
Adrian	53	— 8	25.6	1.55	4.2
Agricultural College	54	—13	24.3	1.76	5.2
Alma	53	—11	25.0	2.51	8.8
Ann Arbor	53	— 4	25.7	2.00	5.9
Arbela	55	— 8	25.3	1.56	4.5
Baldwin	51	—16	22.5	3.79	18.7
Ball Mountain	53	— 7	24.2	1.83	5.4
Baraga	52	— 5	23.7	4.10	41.0
Battlecreek	55	— 7	26.6	2.66	12.1
Bay City *b*	55	— 8	25.7	2.15	8.2
Benton Harbor	58	10	31.0	3.00	20.5
Berlin	51	— 7	24.2	2.32	11.1
Berrien Springs	58	6	27.6	5.80	39.0
Big Rapids	53	—11	23.8	3.06	10.5
Birmingham	52	— 4	25.6	2.17	.....
Boon	51	—15	22.8	4.56	21.9
Calumet	41	— 5	19.2	2.92	36.5
Camden	55	— 9	26.2	2.57	7.5
Carsonville	58	— 6	25.6	1.38	8.0
Charlevoix	52	2	25.1	3.42	26.8
Cheboygan	48	— 7	22.4	1.68	9.6
Clinton	53	— 9	25.4	1.88	7.2
Coldwater	65	— 2	26.8	2.17	.....
Crisps *[10]	44	— 4	23.9	.....	.....
East Tawas	47	— 8	24.8	1.45	.....
Eloise	55	— 6	26.8	1.90	.....
Escanaba †	39	— 6	20.0	1.33	10.0
Fairview	53	— 3	25.0	1.95	7.2
Fitchburg	52	—11	23.6	3.25	19.0
Flint	53	—14	24.1	1.61	7.0
Frankfort *[10]	48	16	30.4	.....	.....
Gladwin	52	—16	24.0	2.40	12.0
Grand Point au Sable *[10]	46	11	28.0	.....	.....
Grand Rapids *b*	57	— 5	27.2	3.77	7.5
Grape	55	— 7	27.4	1.47	8.0
Grayling	48	—22	21.4	3.65	25.0
Hanover	55	— 9	25.4	3.10	9.5
Harrisville	49	— 6	24.2	3.58	24.8
Hart	54	9	26.4	3.19	20.3
Hastings	56	—15	25.2	3.42	10.6
Hayes	55	— 2	27.0	1.51	4.5
Highland Station	48	—11	.....	2.57	12.2
Hillsdale	55	— 8	25.5	2.66	10.5
Holland *[9]	53	13	30.4	.....	.....
Humboldt	44	—18	11.3	0.76	.....
Ionia	54	—13	24.9	1.95	6.0
Iron River	52	—19	13.3	1.04	.....
Ivan	50	— 2	24.6	4.84	37.5
Jackson	55	— 3	26.2	1.54	5.0
Jeddo	51	— 5	24.8	2.32	12.2
Kalamazoo	55	— 3	26.4	2.81	10.0
Lake City	52	— 5	23.2	1.68	12.0
Lansing	55	— 5	24.9	1.77	8.2
Lapeer	54	— 9	25.2	1.00	7.2
Lathrop	42	—13	16.2	1.12	11.0
Ludington	56	9	27.3	2.06	15.4
Luzerne	50	—17	20.6	3.62	25.5
Mackinaw City	50	—11	21.2	2.00	12.0
Madison	53	— 7	26.6	1.86	5.7
Mancelona	50	—11	22.6	5.11	39.0
Manistee	50	9	26.0	3.86	31.0
Manistique	41	— 4	19.8	2.53	17.2
Middle Island *[10]	47	7	28.4	.....	.....
Midland	54	— 8	24.3	1.20	3.0
Mottville	57	— 2	27.2	2.24	8.1
Mount Clemens	53	5	25.6	2.27	1.8
Mount Pleasant *b*	52	—12	24.2	2.44	11.8
Muskegon	52	3	27.7	1.78	.....
Newberry	47	—18	16.0	1.99	16.5
North Marshall	55	—14	25.0	2.78	12.4
Northport	55	8	27.4	2.85	25.5
Old Mission	54	6	26.2	3.14	22.4
Olivet	55	— 5	26.2	2.48	9.2
Omer	50	—20	24.6	1.35	3.0
Ovid	55	— 7	25.1	1.75	5.0
Owosso	56	— 6	24.7	1.67	5.0
Parkville	.....	.....	.....	2.73	10.5
Petoskey	49	— 5	24.4	5.05	41.0
Plymouth	53	—10	25.6	1.64	4.0
Reed City	59	—18	20.5	3.62	19.4
Rockland	50	—15	15.2	1.30	13.2
Rogers City	52	— 9	23.6	3.07	16.0
Romeo	50	— 6	27.2	2.11	.....
Saginaw	56	— 7	25.2	2.40	7.2
St. Ignace	41	—14	19.8	1.84	13.6
St. Johns	55	— 4	26.1	2.18	7.2

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sandbeach[a]	52	— 4	25.4	2.55	3.5
Somerset	52	— 7	24.6	2.16	6.5
Stanton	53	— 6	25.0	1.80	.....
Sturgeon Point*[10]	55	—11	25.0	.....	.....
Thomaston	48	—19	15.2	1.51	14.0
Thornville	52	— 4	26.3	2.29	11.5
Thunder Bay Island*[10]	44	6	26.8	.....	.....
Traverse City	51	6	25.6	2.73	26.1
Valley Center	51	—10	24.0	2.11	.....
Vandalia	57	4	27.2	3.35	17.0
Vassar	55	—12	26.1	1.26	5.6
Vermillion Point*[10]	40	— 4	18.1	.....	.....
Wasepi	58	2	27.0	2.63	8.0
Waverly	56	5	27.2	3.91	16.0
West Harrisville	50	— 5	23.5	2.26	12.8
Wetmore	45	—14	16.5	2.50	23.0
White Cloud	51	—11	22.4	2.74	10.9
Ypsilanti	54	—10	26.6	2.17	7.9
Minnesota.					
Ada†	41	—25	7.4	0.22	4.5
Albert Lea	42	—14	13.2	1.25	12.5
Alexandria†	41	—27	10.7	0.13	1.3
Beardsley	48	—24	13.3	0.39	3.9
Bingham Lake	50	—14	16.0	0.99	2.2
Bird Island	43	—13	14.3	0.05	0.5
Blooming Prairie†	40	—15	13.0	0.60	6.0
Bonniwell	42	—17	13.8	0.13	1.0
Caledonia†	45	—15	15.4	0.92	11.5
Camden	46	—17	16.1	0.07	1.0
Collegeville	41	—16	15.0	0.04	0.4
Crookston†	49	—25	9.6	0.25	2.5
Detroit City	42	—28	5.6	T.	T.
Faribault	45	—14	14.4	0.40	4.0
Farmington†	44	—20	11.6	0.25	2.5
Fergus Falls†	42	—19	10.2	0.61	6.1
Glencoe	46	—18	13.2	0.12	.....
Glenwood	43	—17	11.6	0.45	3.3
Grand Meadow†	39	—17	10.0	0.80	12.4
Koochicking	32	—30	6.4	0.71	7.3
Lake City	41	—18	14.8	0.14	2.5
Lakeside†	44	—16	13.2	T.	T.
Lake Winnibigoshish	34	—26	6.6	0.60	6.3
Lambert†	40	—27	6.0	0.55	5.5
Leech Lake	38	—31	6.6	0.59	6.3
Lesueur*[1]	58	—14	17.2	0.20	2.0
Lutsen	38	—18	15.2	0.48	.....
Luverne†	47	—13	16.6	0.55	5.5
Lynd	42	—18	14.4	0.10	1.5
Mapleplain	.....	.....	.....	0.24	2.4
Maplewood*[1]	46	—14	16.4	.....	.....
Milaca	43	—19	13.0	0.29	3.0
Milan†	46	—22	12.6	0.42	4.2
Minneapolis[a]	46	—15	15.2	0.18	1.8
Minneapolis[b†]	46*	—17	13.2	0.10	1.0
Minnesota City*†[1]	44	—12	16.3	0.78	8.0
Montevideo†	52	—18	15.0	0.10	1.0
Morris	45	—17	12.6	0.06	1.0
Mount Iron[4]	38	—30	3.2	.....	.....
New London	41	—16	11.8	T.	T.
New Richland*[1d]	42	—16	13.2	.....	.....
New Ulm†	45	—11	16.3	0.29	3.0
Park Rapids†	40	—30	6.5	0.62	6.2
Pine River	40	—21	8.4	0.40	4.4
Pleasant Mounds	48	—14	16.0	0.56	7.5
Pokegama Falls	35	—33	5.5	0.67	6.7
Reeds	.....	.....	.....	0.03	.....
Rolling Green	43	—10	15.4	0.70	7.0
Roseau	35	—32	4.2	0.57	5.9
St. Charles†	43	—17	13.6	1.00	10.0
St. Cloud	40	—19	9.0	0.28	2.5
St. Olaf	42	—19	10.2	0.26	3.2
St. Peter	45	—12	17.8	0.10	1.0
Sandy Lake Dam	41	—25	8.5	0.60	6.2
Sauk Center	40	—19	10.5	0.10	1.0
Shakopee[6]	44*	—16	15.8	0.10	1.0
Spring Park	.....	.....	.....	0.08	0.8
Tower†	36	—36	3.8	1.00	10.0
Two Harbors†	40	—16	15.4	0.52	6.5
Wabasha*[1]	40	—10	15.2	0.26	5.0
Willmar†	43	—15	12.2	0.55	5.0
Worthington	43	—13	15.2	0.90	9.0
Zumbrota[1]	40*	—16	14.7	.....	.....
Mississippi.					
Agricultural College	72	24	46.4	11.72	.....
Austin†	71	22	41.8	7.18	2.0
Batesville†	71	24	43.9	6.98	1.0
Bay St. Louis	72	26	52.8	5.46	.....
Biloxi†	74	30	53.5	5.74	.....
Briers	75	25	49.0	6.67	.....
Brookhaven†	75	22	51.6	6.02	.....
Canton†	74	25	48.6	12.28	.....
Columbus[b†]	71	25	46.1	12.81	.....
Corinth	68	26	44.2	7.79	2.0
Crystal Springs†	74	23	49.4	7.84	.....
Edwards	74	26	49.1	14.78	.....
Fayette	.....	.....	.....	9.18	.....
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
French Camps	79	21	45.8	10.83	.....
Greenville[a]	68	26	43.3	9.12	.....
Greenville[b†]	75	26	44.4	8.37	.....
Greenwood	74	23	43.3	9.51	.....
Hattiesburg†	73	27	52.0	3.12	.....
Holly Springs†	68	23	40.6	8.50	.....
Jackson†	72	26	46.5	11.86	.....
Lake†	85	24	46.4	6.60	.....
Leakesville†	79	28	54.5	5.89	.....
Logtown†	75	31	54.4	6.11	.....
Louisville†	71	21	47.5	12.91	.....
Macon†	72	27	48.2	8.50	.....
Magnolia†	76	25	51.4	5.17	.....
Meridian†	77	25	50.5	5.79	.....
Natchez†	78	25	51.2	7.90	.....
Okolona†	72	26	44.0	8.61	.....
Palo Alto	73	24	46.0	11.05	.....
Pontotoc	77	21	45.2	8.06	1.0
Poplarville	78	26	50.0	2.71	.....
Port Gibson†	77	23	49.5	11.70	.....
Ripley	69	22	42.8	7.43	2.5
Rosedale	73	24	42.4	6.84	.....
Stonington*[1]	74	26	49.8	.....	.....
Thornton	70	30	49.7	7.50	.....
Tupelo†	.....	.....	.....	7.68	.....
University	70*	22*	41.4*	5.61	.....
Walnut Grove	68*	21*	43.8*	13.85	.....
Water Valley*†[1]	70	23	43.1	8.53	1.5
Woodville†	76	26	52.0	6.52	.....
Yazoo City†	78	24	47.6	11.22	.....
Missouri.					
Appleton City	66	6	30.2	2.78	8.5
Arthur*[3]	.....	10	28.4	2.06	10.0
Bethany	49	— 7	28.2	2.30	21.0
Birchtree	67	8	31.8	6.61	2.0
Bolckow	.....	.....	.....	1.70	17.0
Boonville†	.....	.....	.....	2.56	0.5
Brunswick	59	4	25.4	1.84	5.5
Carrollton†	61	3	28.3	1.41	9.2
Conception	49	— 4	24.7	1.90	19.0
Cowgill*[5]	54	— 2	25.2	0.95	11.5
Darksville†	60	— 2	25.9	1.61	3.0
Downing	.....	.....	.....	2.69	14.5
East Lynne*[3]	.....	10	29.2	2.71	6.0
Edgehill*[5]	56	14	31.8	4.46	0.2
Eightmile*[1]	66	8	28.7	2.20	6.0
Eldon	65	6	31.0	3.11	5.5
Elmira	60	— 6	25.0	1.01	8.4
Emma*[3]	.....	4	27.2	2.59	4.9
Fairport	.....	.....	.....	0.76	10.0
Farmersville	.....	.....	.....	1.20	11.0
Fayette	64	0	29.6	2.17	7.0
Fulton	.....	.....	.....	1.92	2.0
Gallatin*[1]	52	0	24.6	1.78	10.8
Glasgow	64	— 2	27.7	2.13	3.0
Gordonville*[3]	.....	15	32.8	3.88	0.2
Gorin	.....	.....	.....	2.23	10.0
Halfway	64[f]	11[f]	32.7[f]	4.41	0.5
Harrisonville†	68	5	28.0	2.25	5.0
Hastain	65	7	31.4	2.58	10.0
Hermann†	.....	.....	.....	2.75	0.4
Houston	66	12	35.0	3.74	1.0
Houstonia	.....	.....	.....	3.18	8.9
Irena	.....	.....	.....	2.15	21.0
Ironton†	65	10	32.6	5.31	T.
Jefferson City†	64	6	31.0	2.47	2.0
Kidder	55	— 2	24.0	1.66	10.6
Lamar†	68	10	32.1	1.17	6.0
Lamonte	.....	.....	.....	2.55	6.0
Lebanon	63	11	32.6	5.31	3.5
Lexington	62	— 1	27.8	1.83	3.0
Liberty	65	1	28.4	0.97	9.2
Louisiana	62	2	29.2	2.44	2.0
McCune*†[1]	66	— 2	28.4	3.06	10.0
Mansfield	.....	.....	.....	3.48	1.2
Marblehill	64	12	33.8	5.70	0.2
Marshall†	65	0	26.6	2.35	3.5
Maryville	47	— 9	19.9	1.56	15.5
Mexico†	64	1	27.8	2.08	3.7
Mineralspring	68	10	34.0	4.31	1.0
Montreal	64	10	32.8	3.24	4.8
Mount Vernon	74	12	36.3	4.25	0.5
Neosho	70	12	34.6	2.98	.....
Nevada*[5]	60	8	30.8	.....	.....
New Haven*[1]	62	11	32.6	1.68	2.5
New Palestine*†[1]	62	8	30.7	2.04	2.1
Oakfield	62	9	31.5	3.21	4.0
Oakmound	.....	.....	.....	5.68	.....
Oakridge*[4]	.....	13	33.2	6.09	1.0
Olden†	62	11	33.2	4.76	T.
Oregon[a]	52	— 4	24.1	2.78	20.7
Oregon[b]	53	— 4	23.2	3.12	19.0
Osceola†	.....	.....	.....	1.90	12.0
Palmyra*[5]	60	— 2	26.6	2.59	11.0
Phillipsburg*†[1]	62	12	31.1	4.64	2.5
Pickering*[3]	52	—10	22.5	2.24	21.1
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Platte River*[3]	48	— 3	22.2	1.77	8.5
Poplar Bluff	69*	14*	36.4*	5.48*	*0.5
Potosi	57	3	27.0	4.97	2.0
Princeton	55	— 5	23.2	1.46	12.0
Rhineland	64	9	31.4	3.27	1.5
Richmond	59	0	26.4	1.33	4.0
Rolla	.....	.....	.....	3.84	5.2
St. Charles	62	11	31.4	2.86	3.0
St. Joseph†	.....	.....	.....	1.12	14.0
St. Louis	64	10	31.1	3.40	1.9
Sarcoxie*[3]	.....	9	27.1	2.74	.....
Sedalia	65	1	28.0	1.40	5.0
Seymour*[1]	61	11	32.9	4.32	0.9
Shelbina	.....	.....	.....	2.20	9.0
Sikeston	67	10	35.0	4.32	0.2
Steffenville	58	3	29.0	2.20	9.0
Stellada†	63	5	29.0	2.70	11.0
Sublett	54	—14	21.3	2.27	15.8
Vichy	63	7	31.4	3.20	1.2
Virgil City	.....	.....	.....	2.66	7.0
Warrensburg[1]	.....	.....	29.7	2.54	8.0
Warrenton	63	6	28.0	3.31	4.0
Wheatland	.....	.....	.....	2.12	9.0
Willow Springs	61	10	32.4	5.43	T.
Zeitonia	62	12	35.6	3.23	1.0
Montana.					
Augusta	55	—35	26.8	0.42	1.8
Bigtimber	56	—22	22.0	0.41	3.0
Billings	61	—29	25.4	0.45	4.0
Bozeman†	47	—22	22.2	.....	.....
Bozeman Exper. Stat'n.	50	—15	24.0	0.61	.....
Butte†	45	—18	22.4	1.12	10.1
Castle	45	—18	22.8	3.80	38.0
Chinook†	48	.....	.....	0.23	2.0
Choteau	56	—18	25.8	0.70	3.0
Columbia Falls	46	— 3	24.8	1.82	13.0
Deer Lodge	50	—21	22.0	0.61	5.1
Dupuyer	52	—18	27.0	.....	2.0
Fort Benton	58	—30	25.2	0.80	8.0
Fort Keogh†	50	—39	16.8	0.03	0.3
Fort Missoula	55	— 2	23.3	1.23	3.8
Glasgow	50	—40	12.3	0.25	.....
Glendive†	52	—32	18.3	0.30	3.0
Glenwood	52	—21	21.4	1.45	15.0
Greatfalls†	50	—19	26.6	0.37	3.7
Harlem	48	—34	22.0	.....	.....
Hogan†	50	—14	21.7	0.50	2.0
Kipp†	47	—26	23.0	0.80	5.3
Lewistown	52	—23	24.0	1.10	11.0
Livingston†	50	—12	25.4	0.55	5.0
Manhattan†	45	—28	19.6	0.35	2.5
Martinsdale†	50	—16	24.0	0.50	5.0
Marysville†	46	—16	22.4	1.40	9.8
St Ignatius Mission	58	—10	29.6	1.21	8.0
St. Pauls†	52	—25	22.9	2.60	26.0
Troy	50	—10	24.6	.....	.....
Virginia City†	44	—16	22.4	1.10	11.0
Nebraska.					
Agee*[1]	47	—10	22.2	2.15	24.0
Albion	51	—13	21.4	1.53	.....
Alliance*[1]	48	—16	19.2	1.10	11.0
Ansley†	55	— 9	23.2	1.52	15.2
Arapaho*[1]	52	—15	22.8	1.02	10.2
Arborville*[1]	50	—12	23.8	0.80	8.0
Ashland[a†]	49	—26	20.4	1.13	12.0
Ashland[b*1]	52	—19	23.1	1.13	9.5
Ashton	52	—10	23.4	0.28	3.5
Auburn*†[1]	53	—18	22 5	1.47	14.8
Aurora*[1]	64	— 4	24.8	1.90	19.0
Beatrice†	62	—17	23.5	1.90	19.0
Beaver City†	61	—19	25.6	1.09	11.0
Benedict	.....	.....	.....	1.15	11.5
Blair*[1]	48	—12	21.5	1.70	18.6
Bluehill	.....	.....	.....	0.68	8.0
Brokenbow	.....	.....	.....	1.15	11.5
Burchard	.....	.....	.....	0.90	9.0
Burwell	.....	.....	.....	1.55	15.5
Callaway†	53	—12	22.6	0.95	11.0
Camp Clarke	56	—21	29.8	1.10	11.0
Central City	.....	.....	.....	1.10	11.0
Chester*[1]	56	— 9	23.2	1.30	13.0
Cody	.....	.....	.....	1.15	11.5
Columbus†	49	—13	21.4	1.47	17.7
Cornlea	.....	.....	.....	1.16	11.6
Creighton†	47	—12	19.4	.....	.....
Crete	54	—20	22.0	1.10	11.0
Culbertson	.....	.....	.....	0.85	7.5
Curtis[a]	59	—11	27.7	1.10	11.0
David City*†[1]	48	— 8	22.0	1.30	14.0
Dawson	57	— 6	24.2	1.60	16.0
Divide	.....	.....	.....	1.15	11.5
Dunning*[1]	48	— 3	27.9	1.50	17.0
Eden	.....	.....	.....	1.40	14.0
Edgar*[1]	54	—15	24.5	1.40	14.0
Elba	.....	.....	.....	1.60	16.0
Ericson*†[1]	39	—18	20.2	1.50	15.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ewing†	.....	.....	.....	2.40	23.0
Fairbury†	58	−19	34.0	1.40	14.0
Fairmont†	57	−21	30.8	1.65	17.5
Fort Robinson	58	−18	25.0	1.30	13.0
Franklin	65	−11	27.8	1.40	14.0
Fremont†	46	−21	30.2	2.05	20.5
Geneva†	47	−20	23.5	1.05	10.5
Genoa	49	− 9	21.7	1.44	16.5
Gering†	53	−19	32.8	0.40	4.0
Gordon	.....	.....	.....	0.80	7.0
Gothenburg	55	− 8	23.6	1.50	15.0
Grand Island *a* *1	60	−14	25.6	1.07	10.7
Grand Island *b*	53	− 8	23.0	1.71	17.7
Greeley *1	40	−20	20.3	1.00	10.0
Hartington†	47	−15	18.6	2.95	29.5
Harvard *1	55	−19	21.4	1.62	17.2
Hastings *1	55	−10	21.8	1.39	16.5
Hayes Center	.....	.....	.....	0.50	5.0
Hay Springs	49	−16	20.2	1.12	11.2
Hebron†	58	−14	23.9	1.00	10.5
Hickman	.....	.....	.....	1.80	18.0
Holdrege *b* *1	55	− 7	24.3	1.00	10.0
Imperial†	56	−13	25.0	0.70	6.0
Indianola (near)	.....	.....	.....	1.25	12.5
Johnstown	.....	.....	.....	1.50	15.0
Kearney *5	68	−14	27.2	1.68	16.8
Kennedy	59	−14	22.2	2.40	24.0
Kimball†	54	−16	23.6	1.15	9.0
Kirkwood *1	48	− 8	21.8	1.07	10.8
Lexington†	54	−15	22.8	1.30	13.0
Lincoln *b* †	55	−17	22.5	.....	.....
Lincoln *d*	52	−17	23.0	2.08	21.5
Lodgepole†	59	−18	23.2	0.60	6.0
Loup *b* *1	60	− 8	24.6	1.35	13.5
Lynch* †1	48	−12	22.7	1.10	11.4
Lyons	.....	.....	.....	2.35	23.5
McCook	.....	.....	.....	1.00	10.0
McCool	..	...	.....	1.20	.....
Madison	.....	.....	.....	2.36	23.5
Madrid *5	50	−12	20.4	0.95	9.0
Marquette	.....	.....	.....	1.45	14.5
Merriman	.....	.....	.....	0.40	6.0
Minden *a*	55	−17	23.1	1.61	19.0
Minden *b*	.....	.....	.....	1.15	.....
Monroe	.....	.....	.....	0.91	.....
Nebraska City *b*	.....	.....	.....	1.60	16.0
Nebraska City *c*	50	−14	20.2	.....	.....
Nemaha *1	53	−14	20.7	2.00	20.0
Nesbit	50	−11	22.1	0.59	9.0
Norfolk *a* †	49	−10	19.9	2.10	21.0
Norfolk *b*	50	−13	19.9	2.06	20.5
North Loup	52	− 8	22.6	1.40	14.0
Oakdale†	49	−10	19.8	1.44	18.2
Odell *5	56	−18	24.0	1.30	13.0
O'Neill†	47	−10	19.6	1.86	17.0
Ord	53	− 8	23.6	0.87	.....
Osceola	.....	.....	.....	1.50	15.0
Ough†	.....	.....	.....	0.50	5.0
Palmer *b*	.....	.....	.....	2.00	20.0
Plattsmouth *1	50	− 8	22.0	1.10	11.0
Ravenna *a*	55	−10	23.6	1.53	15.8
Ravenna (*b*) *1	50	− 7	24.6	.....	.....
Redcloud *a*	.....	.....	.....	0.84	10.0
Redcloud *b* *1	54	−10	25.6	1.00	10.0
Republican *1	60	−14	24.2	0.95	9.5
Rulo *1	54	0	26.5	0.40	4.0
St. Libory	52	− 8	24.3	1.90	19.0
St. Paul	52	−10	25.8	1.20	14.2
Salem	62	− 8	23.2	1.45	14.5
Santee Agency†	50	−10	21.2	1.43	17.5
Sargent	.....	.....	.....	1.39	12.5
Schuyler	.....	.....	.....	2.30	23.0
Seneca *1	56	− 6	26.8	1.20	12.0
Seward *1	53	−15	22.6	1.20	12.0
Springview	50	−11	21.9	.....	.....
Stanton *1	49	− 9	20.6	2.40	24.0
Stockham	.....	.....	.....	1.90	19.0
Strang *1	54	−16	25.8	1.10	11.0
Stratton	.....	.....	.....	0.64	.....
Superior *5	54	−11	23.8	0.90	3.0
Sutton	53	−25	20.6	2.82	28.2
Syracuse	.....	.....	.....	1.65	16.5
Tecumseh *b* †	60	−12	27.4	0.73	9.0
Tekamah	49	−19	19.6	2.85	28.0
Thedford *1	58	−12	24.6	1.70	17.0
Turlington†	.....	.....	.....	1.33	13.3
Valentine†	50	−18	22.1	1.03	.....
Valparaiso	.....	.....	.....	0.70	7.0
Wakefield	43	−22	17.2	3.10	31.0
Wallace	.....	.....	.....	0.70	7.0
Weeping Water *1	48	−25	18.7	1.77	25.8
Westpoint†	46	−17	20.2	1.95	19.5
Whitman	.....	.....	.....	1.70	17.0
Wilber *1	56	− 6	27.0	1.05	10.5
Willard	.....	.....	.....	0.10	1.0
Wilsonville *1	56	−19	25.3	1.30	13.0
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wisner	.....	.....	.....	2.78	27.5
Wymore *1	59	−13	25.2	1.80	18.0
York *1	50	−12	23.8	1.30	13.0
Nevada.					
Austin	52	0	28.2	1.20	12.0
Battle Mountain *1	56	10	29.6	0.91	3.0
Beowawe *1	63	8	28.7	0.65	3.0
Blaine	50	− 6	25.6	3.08	9.5
Candelaria	69	5	36.1	0.04	0.5
Carlin *1	48	− 6	25.2	1.61	5.0
Carson City	61	4	32.2	1.72	2.4
Cranes Ranch	.....	.....	.....	1.19	10.0
Darrough	.....	.....	.....	0.00	
Elko *6	62	0	25.8	1.05	6.0
Elko (near)	51	−13	23.4	1.15	7.0
Ely	50	− 9	23.3	1.25	10.0
Empire Ranch	65	−12	26.6	0.22	2.5
Fenelon *1	46	− 3	21.0	1.31	13.0
Golconda *1	58	8	33.4	0.30	1.0
Halleck *1	45	0	19.6	3.57	8.0
Hawthorne *a* *8	64	20	34.5	0.34	1.2
Hawthorne *b*	67	12	35.1	0.30	1.2
Hot Springs *1	50	10	38.2	0.00	
Humboldt *1	51	7	31.4	1.28	5.0
Lewers Ranch	60	5	33.6	4.21	8.0
Los Vegas	55	18	35.0	0.28	T.
Lovelock *1	64	6	31.8	0.25	T.
McGill	52	−14	22.0	1.40	13.5
Martins	61	0	30.5	1.32	4.2
Midas	54	1	30.1	1.08	12.0
Mill City *1	55	5	30.4	0.38	2.0
Monitor Mill	50	−10	24.0	0.80	7.5
Osceola	59	0	28.1	1.53	17.0
Palisade *1	48	0	32.0	0.33	1.5
Palmetto	67	−12	29.3	0.60	6.0
Reno *8	56	12	34.7	.....	T.
Reno State University	59	− 4	31.6	0.87	0.7
Ruby Valley	.....	.....	.....	1.65	11.4
St. Clair	59	7	30.4	0.81	5.0
San Antonio	57	3	26.6	T.	T.
Silver Peak	57	0	30.3	T.	
Sodaville	61	7	32.9	0.15	T.
Tecoma *1	45	0	24.4	0.31	3.0
Toano *1	50	− 6	22.6	2.13	13.0
Tuscarora	45	− 1	24.2	2.26	6.5
Tybo	58	.....	.....	0.45	7.0
Verdi *1	58	10	37.0	1.17	2.0
Wadsworth *1	54	8	26.4	0.98	1.5
Wells	42	−12	21.6	1.14	.....
New Hampshire.					
Bethlehem	57	−10	22.0	3.15	8.0
Concord	59	− 9	26.4	4.74	9.3
Durham	61	− 4	28.0	5.33	14.2
Grafton†	57	−10	23.5	3.81	8.5
Hanover	53	− 6	24.0	3.28	5.2
Keene	56	− 8	25.9	5.17	15.5
Lancaster	44	−14	30.1	3.32	11.8
Nashua	60	− 8	28.2	5.45	10.8
Newton	61	2	28.6	4.66	9.5
North Conway	56	− 5	23.6	4.49	7.5
Peterboro	58	−10	26.1	5.48	17.5
Plymouth	46	− 7	23.2	4.80	12.7
Sanbornton†	55	− 4	23.8	4.67	7.0
Stratford	49	−11	21.5	3.41	7.1
West Milan	55	−14	19.7	3.12	10.0
New Jersey.					
Asbury Park	67	11	37.0	5.02	T.
Barnegat	.....	.....	.....	4.18	0.2
Bayonne	64	12	35.3	5.22	2.6
Belvidere	60	4	32.6	5.39	5.8
Beverly†	66	12	36.4	5.17	0.9
Billingsport *1	63	15	35.6	4.68	.....
Boonton	61	5	32.2	5.68	5.6
Bridgeton	64	18	39.0	4.35	0.2
Camden	62	15	36.2	4.39	1.7
Cape May C. H.†	65	19	37.9	3.92	T.
Charlotteburg	62	2	31.0	5.24	5.0
Chester	57	5	31.6	4.75	8.0
Clayton	67	14	37.4	3.89	0.5
College Farm†	64	7	34.6	5.07	2.5
Deckertown	60	1	32.0	5.30	9.3
Dover	59	4	32.8	5.08	6.0
Egg Harbor City	67	11	36.4	4.56	T.
Elizabeth†	63	7	34.9	5.47	5.0
Englewood	61	− 2	31.3	6.74	9.0
Franklin Furnace	54	2	30.4	4.93	6.5
Freehold	67	10	36.5	4.67	.....
Friesburg	.....	.....	.....	3.68	1.1
Gillette	62	4	34.1	6.09	7.0
Hammonton	.....	.....	.....	4.73	.....
Hanover	60	4	33.9	5.64	6.0
Hightstown	64	12	35.6	3.07	1.0
Imlaystown	65	12	36.4	4.40	0.3
Junction	.....	.....	.....	4.63	4.5
Lambertville	62	7	34.4	4.92	6.5
Moorestown	67	12	36.2	4.95	0.2
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Newark *b* †	62	10	35.2	5.32	4.8
New Brunswick *a*	62	8	35.2	5.22	3.1
New Brunswick *b*	63	8	34.4	5.36	3.5
Newton	59	5	31.6	4.20	7.5
Ocean City	57	15	38.2	4.31	0.5
Oceanic	67	12	37.9	5.41	T.
Paterson	62	11	35.3	5.96	9.5
Perth Amboy	65	9	33.8	5.07	2.0
Plainfield	61	6	33.0	5.23	4.0
Port Norris	66	15	38.0	4.74	T.
Rancocas	.....	.....	.....	4.82	1.9
Readington	60	12	38.8	.....	.....
Rivervale	60	− 3	31.8	5.70	9.0
Roseland	61	4	32.6	6.02	4.5
Sergeantsville	62	8	33.6	4.84	6.0
Somerville	64	− 3	33.0	5.24	3.0
South Orange	62	9	34.0	4.70	6.5
Staffordville	.....	.....	.....	5.29	T.
Toms River	69	8	36.6	5.31	T.
Trenton	63	15	38.2	3.95	T.
Vineland	66	13	37.6	5.35	0.2
Woodbine	65	9	37.8	4.83	.....
New Mexico.					
Albert	68	11	37.4	0.09	1.0
Albuquerque†	59	15	34.4	0.35	3.4
Angus V. V. Ranch	59	4	32.2	0.30	3.0
Aztec†	55	0	24.7	0.32	2.0
Bernalillo†	61	13	34.7	0.07	T.
Bluewater	62	− 4	28.2	0.50	5.0
Buckmans	47	−17	19.5	1.35	16.4
Clayton	74	5	34.2	1.15	11.5
Deming *8	68	18	40.9	T.	
East Lasvegas†	65	1	30.4	0.59	10.0
Eddy	78	10	39.4	T.	T.
Engle†	65	11	35.6	0.00	
Espanola	58	− 3	27.0	0.30	3.0
Fort Bayard	71	9	38.2	0.25	2.5
Fort Union	72	2	35.0	T.	T.
Fort Wingate	65	0	30.9	2.55	.....
Galisteo†	55	3	30.1	0.90	9.0
Gallinas Spring†	67	2	33.0	0.50	5.5
Gila	65	15	39.3	0.19	T.
Hillsboro	70	18	38.6	0.10	1.0
Las Cruces†	68	9	38.8	0.03	
Lordsburg *8	68	19	40.0	0.18	1.5
Los Lunas	57	8	32.9	0.15	
Lower Penasco	71	14	38.5	0.25	2.5
Monero	48	− 7	21.8	0.70	7.4
Raton	70	2	31.7	0.10	1.0
Rincon†	70	15	41.0	T.	
Roswell†	76	8	37.4	T.	T.
Socorro	62	14	35.2	0.00	
White Oaks†	57	6	35.0	0.78	7.0
Winsors Ranch	59	−11	26.4	1.04	18.5
New York.					
Adams	.....	.....	.....	3.95	.....
Addison	61	2	31.1	1.91	9.8
Akron	.....	.....	.....	4.20	.....
Angelica†	59	− 2	29.6	3.10	14.0
Appleton	60	5	30.2	3.34	14.6
Arcade	57	− 4	27.5	3.47	15.2
Arkwright	55	3	28.8	.....	.....
Atlanta	.....	.....	.....	3.01	.....
Auburn	59	3	29.6	2.92	12.0
Avon	62c	1c	30.6c	1.65	.....
Baldwinsville *d	61	4	26.4	3.64	12.0
Bedford	62	− 1	33.4	4.23	8.4
Big Sandy *10	58	− 4	27.2	.....	.....
Binghamton†	61	2	30.1	4.03	14.7
Bolivar	61	− 2	29.7	3.02	11.0
Bouckville	55	− 6	25.6	3.43	19.0
Boyds Corners	.....	.....	.....	6.56	12.5
Brentwood	61	5	35.2	5.50	1.5
Brooklyn	63	11	35.6	4.74	3.2
Canajoharie	59	1	29.4	4.60	18.5
Canton	58	−21	22.1	3.21	13.0
Carmel	55	1	30.8	5.22	11.8
Catskill	58	4	31.2	5.98	19.0
Cedar Hill	.....	.....	.....	5.02	12.0
Charlotte *10	57	9	29.8	.....	.....
Cherry Creek	.....	.....	.....	5.30	.....
Cooperstown†	58	− 5	27.8	4.64	21.5
Cortland	58	− 1	28.6	3.00	7.5
Dekalb Junction	.....	.....	.....	2.84	.....
Dryden	64	2	29.3	.....	.....
Eagle Mills	.....	.....	.....	3.87	.....
Easton	.....	.....	.....	5.08	.....
Elmira	60	4	32.2	1.60	.....
Fayetteville	.....	.....	.....	2.54	.....
Fleming	57	2	29.9	1.92	8.0
Fort Niagara†	63	4	31.2	2.77	5.0
Franklinville	59	− 1	28.1	4.01	19.0
Fulton	.....	.....	.....	4.79	.....
Garrattsville	60	−10	26.6	2.45	21.2
Glens Falls	55	− 7	23.9	4.71	17.5
Gloversville	54	− 4	24.8	6.52	22.8

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Greenwich	57	— 9	26.3	4.59	7.0
Haskinsville	....	.....	.. ..	2.10	.....
Honeymead Brook	57	— 1	29.5	5.39	14.5
Humphrey †	62	0	28.6	3.59	21.6
Ithaca	61	3	30.7	2.56	11.6
Jamestown	58	5	30.2	4.32	22.5
Kings Station	.....	.....	.....	6.27	.....
Lake George	54	— 5	25.9	4.75	12.8
Lake Placid	53	—11	23.1	1.90	8.5
Little Falls	60	— 3	23.4	5.22	20.5
Lockport [b]	60	12	33.2	.....	.....
Lowville	55	—12	23.7	3.02	17.0
Lyons	65	5	31.4	3.14	14.0
Madison Barracks †	61	—11	25.4	3.68	32.6
Middletown	59	5	29.8	5.71	16.0
Mohonk Lake	54	4	28.6	5.44	15.0
Mount Morris	.....	.....	.....	1.80	13.0
Napoli	.....	.....	.....	4.39	.....
Newark Valley	.....	.....	.....	2.85	.....
New Lisbon	59	—10	26.2	4.20	21.0
Niagara Falls	.....	.....	.....	3.56	.....
North Hammond †	60	—10	25.6	2.51	11.8
North Lake	52	—16	20.2	5.74	27.0
Number Four †	51	—13	21.8	4.60	30.7
Ogdensburg	59	—12	23.6	2.77	5.8
Oneonta	62	— 1	30.6	5.30	.....
Oxford	57	— 2	27.4	4.01	18.3
Palermo	54	— 6	26.3	4.08	22.2
Penn Yan	63	2	31.2	1.56	5.1
Perry City	60	0	27.6	2.86	11.7
Phœnix	.....	.....	.....	3.25	... ..
Pine City	.....	.....	.....	2.04	.....
Pittsford	63	2	30.3	2.26	.....
Plattsburg Barracks †	55	— 4	23.6	1.96	.....
Port Jervis	59	3	29.9	6.76	10.0
Poughkeepsie	62	— 4	33.4	4.57	5.5
Primrose	62	1	32.2	5.42	6.3
Ridgeway	63	4	29.9	2.80	15.5
Rome	56	— 5	24.0	3.49	.....
Romulus	59	4	30.4	2.01	4.1
Rose	.....	.....	.....	3.57	.....
St. Johnsville	64	— 4	29.2	4.65	13.5
Saranac Lake	56	—19	19.8	2.22	15.0
Setauket †	60	12	36.7	6.60	2.5
Sherwood	.....	.....	.....	2.55	.....
Skaneateles	.....	.....	.....	3.48	.....
South Canisteo	61	— 1	29.1	2.61	14.2
Southeast Reservoir	.....	.....	.....	4.78	9.8
South Kortright †	59	— 4	27.4	4.02	.....
Straits Corners	60	— 2	28.3	2.12	9.2
Ticonderoga	57	— 5	27.4	4.10	4.6
Wappingers Falls	61	1	31.3	5.99	15.0
Warwick	.....	.....	.....	4.15	.....
Watkins	63	2	30.2	.....	5.8
Waverly †	63	— 5	31.0	2.70	11.8
Wedgwood	60	— 2	28.1	1.93	10.0
Westfield	62	6	32.3	2.71	7.5
Westpoint †	57	3	31.0	5.60	.....
Willetspoint	64	10	35.3	5.06	5.4
North Carolina.					
Abshers	70	14	41.6	3.26	T.
Asheville †	68	15	40.0	3.18	0.5
Beaufort †	73	26	51.4	7.07	
Biltmore †	67	16	39.6	3.04	0.2
Bryson City †	.....	.....	.....	6.78	
Chapelhill †	70	18	42.7	2.72	
Edenton	68	20	45.5	3.81	
Experimental Farm	65	20	44.6	2.12	T.
Fairbluff †	.....	.....	.....	3.26	
Fayetteville †	72	19	45.2	2.13	
Flatrock	63	15	39.4	4.66	T.
Greensboro †	65	19	41.2	3.05	
Henderson †	68	18	42.2	3.58	
Highlands	57	14	38.0	6.36	0.5
Horse Cove	60	20	41.7	5.99	T.
Lenoir *† [1]	63	21	40.6	3.26	T.
Linville †	59	10	36.8	4.57	5.0
Littleton †	67	12	41.2	2.61	
Louisburg †	66	18	43.0	2.70	T.
Lumberton †	68	24	45.1	2.56	
Lynn †	69	20	44.5	2.93	
Marion	67	19	42.7	3.86	0.1
Mocksville	.....	.....	.....	2.66	
Moncure †	67	20	44.6	2.28	
Monroe †	64	20	42.5	2.17	
Morganton	65	20	41.3	3.49	
Mountairy	68	13	39.7	3.32	T.
Mount Pleasant	68	20	42.6	2.94	.....
Murphy †	.....	.....	.....	6.85	
Newbern †	76	29	52.2	4.79	
Oakridge †	65	10	40.4	2.93	
Pantego	.....	.....	.....	5.80	
Pittsboro †	68	18	42.4	2.54	
Rockingham †	73	23	46.2	3.41	
Roxboro †	.....	.....	.....	3.34	
Salem †	66	16	40.6	2.50	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Salisbury †	68	20	43.3	2.89	
Saxon †	70	13	40.0	2.72	T.
Selma	70	20	44.8	2.85	
Settle	68	16	40.6	2.77	T.
Sloan †	72	19	47.6	3.06	
Soapstone Mount †	68	15	41.1	3.11	
Southern Pines *a* †	72	23[c]	47.0	.....	
Southern Pines *b*	71	22	46.3	2.35	
Southport †	71	27	50.4	6.27	
Springhope *[1]	68	20	41.2	2.50	
Tarboro	74	14	43.4	3.48	
Waynesville †	64	17	41.3	3.67	0.2
Weldon †	70	18	44.0	2.91	
Willeyton	73	17	43.6	4.76	
North Dakota.					
Aneta	44	—34	8.0	0.25	2.5
Ashley †	47	—27	11.3	0.10	1.0
Bottineau	37	—31	4.4	0.50	5.0
Buxton	38	—25	9.2	0.13	1.3
Churchs Ferry	44	—24	9.4	0.29	2.9
Coalharbor †	53	—36	13.7	0.29	2.9
Dickinson	48	—25	18.2	T.	T.
Dunseith	38	—30	5.2	T.	T.
Ellendale	48	—21	15.0	T.	T.
Falconer	53	—34	13.6	0.02	0.2
Fargo †	42[b]	—22	6.5[d]	0.04	0.4
Forman †	44	—28	11.2	0.25	2.5
Fort Berthold	69	—35	26.2	0.07	0.7
Fort Yates †	57	—26	14.6	0.50	5.0
Gallatin †	43	—32	8.2	0.51	5.1
Glenullin	49	—29	15.6	T.	T.
Goetz	49	—29	12.5	0.10	.....
Grafton †	40	—22	7.0	0.40	4.0
Grand Rapids †	52	—22	12.5	0.36	3.6
Hamilton	40	—24	5.8	0.87	6.0
Jamestown †	45	—23	12.2	0.50	5.0
Kelso	40	—24	7.2	.....	.....
Larimore †	45	—23	8.0	T.	T.
McKinney	46	—30	9.6	0.29	2.9
Mayville	.....	—30	.....	0.30	3.0
Medora †	49	—32	16.2	0.02	0.2
Milton †	40	—25	5.4	0.20	2.0
Minnewaukon	48	—25	9.0	T.	T.
Minto †	42	—26	7.3	0.10	1.0
Napoleon †	46	—24	12.6	0.45	4.5
New England City	45	—31	15.3	0.30	3.0
Oakdale †	52	—19	20.2	0.70	7.0
Portal	44	—30	9.6	0.20	2.0
Power †	51	—24	8.0	0.20	2.0
St. John †	44	—26	8.1	0.20	2.0
Sheyenne	44	—25	10.6	0.50	5.0
Steele †	49	—27	11.2	0.10	.....
Towner †	47	—27[c]	7.2[d]	.....	.....
University †	38	—23	8.2	0.24	2.4
Valley City †	.....	.....	.....	0.28	2.8
Wahpeton †	47	—21	14.0	0.17	1.8
White Earth	46	—32	12.8	0.02	0.2
Wildrice † [2]	.....	.....	8.5	0.34	3.4
Willow City	43	—30	6.7	0.00	
Woodbridge †	37	—25	6.9	0.08	0.8
Ohio.					
Akron	59	3	32.4	1.74	5.3
Annapolis	64	0	31.8	2.51	8.0
Ashland	59	2	29.6	1.56	6.5
Ashtabula	60	5	31.9	3.12	11.0
Atwater	.....	.....	.....	1.84	4 5
Bangorville	59	— 3	30.8	2.92	8.8
Basil	....	....	.....	1.09	4 0
Bellefontaine	60	.....	.....	0.90	0.5
Bement	.....	.....	.....	1.72	3 2
Benton Ridge	59	0	30.4	1.51	3.0
Bethany	65	9	36.0	2.92	4.2
Bigprairie	60	0	30.2	2.32	5.5
Binola	....	.....	.....	1.67	6.5
Bissells	59	2	30.4	2.14	10.7
Bloomingburg	69	5	34.1	2.06	.....
Bowling Green	59	— 6	29.1	1.83	3.5
Cambridge	64	3	33.2	3.00	5.0
Camp Dennison	65	12	35.8	2.39	4.4
Canal Dover	62	3	32.3	2.64	8.5
Canton †	63	3	33.0	2.03	4.1
Cardington	61	0	30.4	1.30	2.0
Carrollton	62	2	33.0	2.73	10.0
Cedarville	.....	.....	.....	2.82	6.5
Celina	61	0	31.2	1.26	0.8
Cherryfork	66	2	34.8	4.19	6.2
Chillicothe	63	10	36.3	2.22	4.0
Circleville	64	8	35.5	2.80	6.0
Clarksville	67	7	35.0	2.20	4.5
Cleveland *a*	60	10	32.7	1.90	6.6
Cleveland *b*	61	8	31.0	1.34	7.0
Clifton	65	4	32.6	3.50	7.3
Coalton	65	6	36.6	2.61	4.0
Colebrook	59	2	31.5	2.84	9.5
Dayton *a*	66	5	34.0	3.24	6.5
Dayton *b* †	.....	.....	.....	2.65	3.6

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Defiance	57	— 3	29.0	1.84	6.2
Delaware	62	3	33.3	2.22	5.0
Demos	64	2	33.8	3.10	.....
Dupont	58	— 3	28.7	0.93	4.0
Elyria	62	5	31.6	1.33	7.3
Fairport Harbor *[10]	62	12	33.4	.....	.....
Fayetteville	64	5	34.6	2.89	7.3
Findlay	60	1	30.4	2.01	.....
Frankfort	65	7	35.1	2.62	6.0
Garrettsville †	61	— 5	30.9	2.45	6.7
Granville	65	2	31.4	2.97	11.0
Gratiot	64	4	33.6	2.51	10.6
Greenfield	63	11	35.8	2.00	5.0
Greenhill	62	— 2	31.5	2.41	8.3
Greenville	59	5	31.1	1.91	2.5
Hackney	68	.....	.....	2.56	7.0
Hanging Rock	69	8	38.8	3.42	3.0
Hillhouse	60	1	29.6	2.84	14.0
Hillsboro †	68	5	35.6	2.61	4.5
Hiram	60	2	29.4	2.50	8.0
Hudson	59	2	31.1	2.89	10.5
Jacksonboro	65	6	33.0	3.12	7.5
Kenton †	62	0	32.2	2.53	3.5
Killbuck	61	0[a]	33.5[d]	2.41	7.0
Lancaster	65	8	35.0	2.36	6.0
Leipsic	59	— 7	29.1	1.73	4.5
Levering	62	2	30.9	2.57	6.0
Logan	71	6	35.7	3.28	5.5
Lordstown	62	0	30.5	2.36	5.5
McArthur	66	6	35.3	2.78	6.0
McConnelsville †	68	5	35.4	4.96	8.0
Mansfield †	.....	.....	.....	1.45	5.0
Marietta *b*	65	10	37.7	3.23	4.0
Marion	63	0	32.2	2.04	4.7
Medina	60	0	31.3	1.86	4.0
Milfordton	59	0	29.0	2.30	7.0
Milligan	67	3	35.0	2.09	9.0
Millport	61	— 3	31.2	2.65	6.0
Montpelier	55	— 2	27.0	2.66	6.0
Napoleon	..	— 3	.....	1.81	6.0
New Alexandria	59	3	33.8	3.35	9.5
New Berlin	59	0	30.7	1.82	5.6
New Bremen	60	0	31.8	1.95	3.5
New Comerstown	64	4	33.4	1.35	3.0
New Holland	64	8	34.0	2.48	7.8
New Moscow	.....	.....	.....	2.07	7.9
New Paris	61	3	32.1	2.28	6.6
New Waterford	62	4	33.5	4.49	13.5
North Lewisburg	60	2	31.4	2.80	6.0
North Royalton	58	2	31.2	2.21	7.0
Norwalk	61	— 1	31.0	1.18	4.0
Oberlin	61	0	33.2	1.99	2.7
Ohio State University	65	6	34.2	2.60	5.5
Orangeville	58	— 2	30.8	2.46	7.5
Ottawa	60	0	32.2	1.53	3.0
Pataskala †	63	4	33.4	2.95	11.5
Perry	.....	.....	.....	1.92	8.0
Philo	57	4	33.3	1.59	1.8
Plattsburg	64	4	32.3	3.33	9.0
Point Marblehead *[10]	60	8	33.2	.....	.....
Pomeroy	65	7	38.0	2.40	6.0
Portsmouth *a* †	.....	.....	.....	3.09	1.0
Portsmouth *b*	67	6	38.3	3.90	3.6
Richwood	61	4	32.2	2.53	4.2
Ridgeville Corners	55	— 5	28.1	1.51	5.0
Ripley	65	8	36.4	3.83	5.0
Rittman	59	— 1	30.6	1.96	5.0
Rockyridge	59	— 3	29.6	1.94	11.1
Rosewood	60	3	31.6	1.99	3.5
Shenandoah	59	— 3	29.8	1.55	2.9
Sidney *b*	61	4	30.7	2.24	3.8
Sinking Spring †	63	9	35.8	3.44	6.0
Somerset †	63	.....	.....	2.01	4.0
Springboro	...	...	...	2.77	3.0
Spring Valley	63	6	33.0	3.30	4.0
Strongsville	.....	.....	.....	1.94	5.9
Sylvania	55	— 7	26.0	1.21	4.0
Thurman	69	5	37.5	2.30	3.0
Tiffin †	60	2	31.4	2.26	6.1
Upper Sandusky	61	1	32.4	1.71	5.0
Vanceburg	68	7	38.0	3.77	3.0
Van Wert	58	— 1	28.4	1.65	5.0
Vermilion	60	2	33.1	1.45	8.5
Vickery	61	1	31.0	1.91	5.3
Walnut	.....	.....	.....	2.24	6.6
Warren	60	6	32.2	2.90	9.4
Warsaw	63	0	32.4	2.71	8.5
Wauseon	57	— 7	28.6	1.88	6.9
Waverly	66	8	36.3	2.98	5.3
Waynesville	64	4	33.0	3.15	6.0
Wellington	61	0	31.6	1.74	4.8
Westerville	66	7	34.6	2.69	6.4
Willoughby	.....	.....	.....	1.59	4.2
Wooster *b* †	60	2	31.8	2.50	5.2
Youngstown	59	4	31.8	2.54	4.0
Zanesville †	.....	.....	.....	2.61	3.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oklahoma.	°	°	°	*Ins.*	*Ins.*
Anadarko†	75	4	39.0	0.30	
Arapaho†	67	1	34.2	0.23	1.0
Burnett†	74	8	36.2	0.76	0.3
Clifton†	75	7	36.0	0.97	0.5
Edmond	81	6	36.4	0.77	4.8
Fort Reno†	69	0	37.8	.....	.....
Fort Sill	72	4	35.7	0.82	2.2
Guthrie	69	6	36.7	0.69	
Hennessey	67	10	32.5	0.20	2.0
Jefferson*	75	5	36.4	0.50	2.0
Kingfisher	68	3	38.6	0.53	.....
Mangum†	74	3	36.8	0.21	
Newkirk	65	14	37.0	1.52	2.2
Norman†	73	6	37.3	0.86	
Prudence†	63	2	33.6	0.71	2.0
Stillwater†	66	4	32.1	0.87	.....
Waukomis	68	2	36.2	.....	.....
Winnview[6]	66	4	33.6	0.42	2.5
Oregon.					
Albany *a*	58	29	44.2	8.92	
Arlington	56	21	35.0	2.79	0.5
Ashland *b*	66	23	40.1	3.13	0.3
Aurora**	57	25	42.4	7.65	
Aurora (near)	60	22	41.8	8.23	T.
Bandon	59	30	48.2	5.45	
Bay City†	55	30	44.6	37.42	
Beulah	64	0	30.5	2.28	11.5
Brownsville**	65	35	46.2	4.87	
Burns	46	— 4	24.3	0.95	7.0
Burns (near)	55	9	32.4	1.72	2.8
Cascade Locks	57	26	37.2	19.26	7.0
Comstock**	58	33	45.5	7.93	
Coquille River	.....	.....	.....	6.73	
Corvallis	58	27	43.3	7.09	T.
Dayville†	81	13	37.9	1.69	1.0
Eugene	.....	31	.....	6.17	T.
Fairview	59	31	45.9	9.80	
Falls City	55	26	41.5	21.96	T.
Fife†	52	2	31.4	1.99	5.0
Forest Grove	58	23	41.1	.....	.....
Fort Klamath	46[f]	4[f]	28.4[f]	3.34	14.5
Gardiner	60	31	47.7	11.97	
Glenora	57	25	41.6	42.21	
Government Camp	48	8	32.6	17.09	45.0
Grants Pass *a*†	57	25	41.2	6.13	
Happy Valley	56	— 1	30.2	1.74	3.5
Heppner	60	9	34.5	1.73	1.8
Hood River (near)	52	22	34.7	12.54	3.0
Irvington	.....	.....	.....	7.76	
Jacksonville	59	22	38.8	4.81	T.
Joseph	52	2	26.6	1.09	9.5
Junction City**	62	32	46.3	6.37	
Klamath Falls	49[e]	13[e]	31.2[e]	2.65	.....
Lafayette**	58	28	44.0	11.10	0.5
Lagrande	48	9	32.7	.....	.....
Lakeview†	49	6	30.0	1.68	6.5
Langlois	70	31	49.6	11.23	
Lone Rock	59	3	30.7	1.18	0.5
Lorella	50	2	29.9	4.85	10.5
McMinnville	58	24	41.8	11.33	T.
Merlin**	52	22	37.3	6.75	
Monmouth**	61	28	43.0	7.36	
Monroe	58	27	43.6	8.75	T.
Mount Angel†	59	28	42.8	7.03	
Nehalen	.....	.....	.....	21.74	
Newberg	59	24	42.4	12.15	T.
Newbridge	48	10	31.0	1.42	8.5
Newport	57	30	46.1	9.80	
Pendleton	62	14	37.7	2.16	2.0
Prineville	66	11	41.4	1.75	
Riddles**	62	30	43.5	4.48	
Riverside	53	9	33.8	1.61	
Salem *b*†	58	25	43.0	7.76	
Sheridan**	55	30	45.2	8.90	0.5
Silver Lake	50	3	31.0	1.47	0.7
Silverton**	56	30	44.8	7.55	1.0
Siskiyou**	51	20	36.2	4.04	16.0
Sparta	52	8	27.1	4.37	41.0
Springfield**	55	31	42.7	6.74	
Stafford	58	22	41.5	12.18	.....
The Dalles†	56	22	35.7	4.03	4.0
Toledo	62	27	44.4	14.15	
Umatilla	.....	.....	.....	1.64	2.0
Vale	48	8	30.0	1.59	4.7
Vernonia	54	22	39.7	14.32	0.2
West Fork**	60	30	42.4	9.73	
Weston	58	7[d]	34.2[b]	3.46	5.5
Williams	59	22	40.6	6.14	
Pennsylvania.					
Altoona	64	13	39.2	2.17	.....
Aqueduct	68	8	36.4	3.15	6.6
Beaver Dam	.....	.....	.....	2.82	4.0
Bethlehem	.....	.....	.....	4.22	.....
Brookville†	.....	.....	.....	4.82	10.1
Browers Lock	.....	.....	.....	4.32	.....
Pennsylvania—Cont'd.					
Cameron	.....	.....	.....	2.69	2.0
Canonsburg	73	44	37.4	4.19	11.5
Carlisle	64	9	34.2	3.29	5.0
Cassandra	58	6	32.2	3.75	9.7
Cedarrun	.....	.....	.....	1.90	12.0
Centerhall†	54	6	31.1	4.19	19.0
Chambersburg†	67	7	33.8	1.93	.....
Coatesville	68	7	35.4	4.96	6.4
Confluence†	63	0	32.3	4.36	5.0
Coopersburg	67	9	37.4	4.76	4.2
Davis Island Dam†	..	.....	.....	2.54	3.0
Derry Station	63	0	33.4	3.96	3.0
Doylestown	.....	.....	.....	4.68	.....
Driftwood	.....	.....	.....	2.74	8.0
Duncannon	.....	.....	.....	3.71	6.0
Dushore	60	— 3	29.6	2.74	17.8
Dyberry	62	— 5	27.6	4.71	12.0
East Bloomsburg	.....	.....	.....	4.13	7.8
East Mauch Chunk	62	5	32.4	5.16	8.0
Easton	61	8	33.8	5.63	6.0
Edinboro*[1]	54	5	28.6	.....	.....
Ellwood Junction†	.....	.....	.....	3.07	3.0
Emporium	61	3	32.1	4.20	12.6
Everett	.....	.....	.....	3.96	4.0
Farrandsville	.....	.....	.....	3.20	9.0
Forks of Neshaminy*[1]	59	10	36.2	5.16	.....
Franklin	60	— 6	32.2	3.20	7.2
Frederick	.....	.....	.....	4.26	.....
Freeport†	.....	.....	.....	3.84	6.0
Girardville	.....	.....	.....	5.92	19.5
Grampian	60	0	30.0	4.57	14.0
Greensboro†	65	2	36.2	4.86	5.0
Greenville	60	8	33.5	4.73	19.5
Hallstead†	61	0	29.6	4.00	16.1
Hamburg	60	12	35.7	6.25	5.0
Hawley	66	0	32.4	5.05	16.4
Hollidaysburg	67	3	34.0	3.46	5.0
Huntingdon *a*†	66	6	36.0	3.19	10.6
Huntingdon *b*	.....	.....	.....	3.18	.....
Irwin	.....	.....	.....	4.23	13.0
Johnstown†	64	2	34.7	3.74	4.0
Karthaus	.....	.....	.....	2.75	16.0
Keating	.....	.....	.....	2.28	12.2
Kennett Square	63	9	35.6	4.59	3.8
Lansdale	.....	.....	.....	4.69	.....
Lawrenceville	60	0	30.8	2.02	8.0
Lebanon	65	11	34.4	4.05	3.8
Leroy†	59	— 2	28.3	2.89	13.5
Lewisburg	63	8	33.4	3.94	9.0
Lock Haven *a*†	61	8	34.2	.....	.....
Lock No. 4†	.....	.....	.....	3.34	7.0
Lycippus	62	5	33.6	5.43	12.8
Mifflin	.....	.....	.....	2.48	2.0
Oil City†	.....	.....	.....	3.63	7.8
Ottsville	.....	.....	.....	4.71	.....
Parker†	.....	.....	.....	3.38	4.0
Philadelphia *b*	63	16	37.6	4.55	1.6
Point Pleasant	.....	.....	.....	4.57	.....
Pottstown	64	10	36.2	5.00	6.5
Quakertown	63	1	32.8	4.70	4.0
Reading[2]	.....	.....	34.4	4.60	.....
Reedsville	60	9	32.6	1.28	.....
Renovo *a*	.....	.....	.....	3.01	11.0
Renovo *b*	63	7	33.5	3.54	15.0
Ridgway†	.....	.....	.....	3.46	10.2
Saegerstown	59	— 6	29.2	3.49	10.2
St. Marys	58	1	28.2	2.97	10.0
Salem Corners	58	0	29.3	5.21	19.0
Scranton	67	2	31.8	3.64	12.0
Seisholtzville	.....	.....	.....	4.48	.....
Selinsgrove	62	6	35.0	3.56	7.8
Shawmont	.....	.....	.....	3.87	2.1
Shinglehouse	62	0	29.9	3.14	12.0
Sinnamahoning	.....	.....	.....	2.12	.....
Smethport	61	0	28.7	3.25	8.0
Smiths Corners	.....	.....	.....	4.57	.....
Somerset	58	0	31.9	5.50	17.5
South Bethlehem	59	10	34.0	.....	.....
South Eaton	63	4	31.8	4.13	14.0
State College	60	6	31.8	3.18	9.5
Sunbury	.....	.....	.....	2.80	5.0
Swarthmore	60	13	35.4	3.94	2.0
Swiftwater	57	2	29.8	5.91	14.5
Towanda	65	3	31.8	2.78	12.5
Uniontown	65	7	36.3	4.30	.....
Warren†	58	4	29.2	2.60	11.0
Wellsboro†	62	2	31.4	3.09	11.0
West Chester	60	13	35.0	4.21	4.2
West Newton†	.....	.....	.....	2.97	1.0
White Haven	62	2	30.6	4.20	13.0
Wilkesbarre†	64	8	33.0	3.80	13.0
Williamsport	61	9	33.4	3.64	12.8
York†	65	11	34.9	3.37	4.4
Rhode Island.					
Bristol	56	12	34.5	5.35	2.5
Providence *a*	60	11	34.8	4.99	4.0
South Carolina.					
Anderson†	.....	.....	.....	2.76	
Batesburg†	70	27	48.6	1.40	
Blackville†	77	26	48.4	1.76	
Camden†	.....	.....	.....	1.92	
Central	78	22	45.2	.....	
Cheraw *a*†	76	21	44.4	1.97	
Cheraw *b*†	.....	.....	.....	2.41	
Clemson College	66	22	45.0	2.96	
Conway†	.....	.....	.....	3.01	
Darlington (near)	.....	.....	.....	2.19	
Edisto†	.....	.....	.....	1.63	
Effingham†	.....	.....	.....	2.29	
Florence†	66	28	46.0	2.91	
Gaffney†	.....	.....	.....	2.73	
Georgetown†	73	30	49.6	1.10	
Gillisonville	79	26	51.6	2.55	
Greenville†	68	22	43.7	2.39	
Greenwood	74	27	46.0	1.92	
Holland	70	21	46.4	3.09	
Kingstree *a*†	74	27	48.4	2.57	
Kingstree *b*	.....	.....	.....	2.63	
Little Mountain	78	25	48.2	2.13	
Longshore†	69	26	46.2	1.98	
Mount Carmel†	.....	.....	.....	1.56	
Pinopolis*[1]	70	32	49.2	3.05	
Port Royal†	74	35	53.4	2.07	
St. Georges†	74	29	49.0	2.30	
St. Matthews†	76	27	49.0	1.82	
St. Stephens†	.....	.....	.....	2.27	
Santuck†	69	22	44.8	2.23	
Shaws Fork	76	24	49.3	2.63	
Smiths Mills†	.....	.....	.....	2.92	
Society Hill†	66	26	46.4	2.10	
Spartanburg	65	24	43.6	2.80	
Statesburg†	69	28	47.8	2.20	
Trenton	69	30	49.8	1.54	
Trial†	82	25	52.0	3.20	
Walhalla	65	22	43.3	4.11	T.
Winnsboro	80	24	45.8	2.72	
Yemassee†	76	28	50.0	2.64	
Yorkville	70	26	46.6	2.50	T.
South Dakota.					
Aberdeen†	46	—22	11.3	0.42	4.2
Alexandria†	50	—16	15.7	0.50	4.5
Armour	50	—12	20.0	1.14	11.0
Ashcroft†	69	—33	20.4	0.30	3.0
Brookings†	43	—20	16.1	0.34	3.4
Canton	45	—21	16.6	1.10	14.0
Castlewood	48	—21	14.1	0.38	3.8
Centerville	.....	.....	.....	1.02	15.0
Chamberlain†	52	—19	20.4	0.22	3.0
Clark	.....	.....	.....	0.27	2.7
Cross†	60	—16	25.1	0.19	2.6
De Smet	41	—22	13.8	0.60	6.0
Doland	44	—28	14.0	0.29	3.8
Edgemont	.....	.....	.....	0.28	2.8
Eureka	45	—24	16.0	0.15	1.5
Farmingdale	.....	.....	.....	0.20	.....
Flandreau	44	—20	15.0	0.46	4.7
Forestburg†	46	—23	16.5	0.21	2.1
Forest City	53	—23	17.4	0.10	1.0
Fort Meade†	66	—13	25.8	T.	T.
Gann Valley	43	—22	16.8	0.40	5.0
Gary	46	—15	14.6	0.00	0.0
Goudyville	50	—24	14.8	0.05	1.0
Greenwood	48	—13	21.0	1.18	11.8
Highmore	47	—18	17.0	0.40	4.0
Hotch City†	47	—21	19.3	0.30	3.5
Hot Springs	18[c]	—14	24.2	0.14	1.8
Howard†	45	—21	15.4	0.80	8.0
Interior	55	—20	22.2	0.10	1.0
Ipswich	50	—22	15.3	T.	T.
Kimball†	50	—15	18.6	0.70	7.0
Leslie†	60	—35	16.1	0.08	.....
Mellette†	48	—25	13.5	0.10	1.0
Menno†	47	—14	18.7	0.96	10.3
Millbank	46	—18	14.0	0.15	1.5
Mitchell†	49	—19	17.9	0.53	7.3
Nowlin	54	—20	22.3	0.23	2.3
Oelrichs†	52	—19	22.3	1.00	10.0
Parker†	45	—21	16.7	1.65	16.5
Plankinton†	47	—18	17.4	0.86	8.5
Redfield	49	—23	15.8	0.32	3.0
Rochford	59	—20	21.8	1.40	9.0
Rosebud	54	—15	22.0	2.40	24.0
Shiloh	56	—24	18.2	0.01	0.1
Silver City	.....	.....	.....	0.40	4.0
Sioux Falls†	45	—22	16.8	0.68	6.0
Spearfish†	62	—16	28.2	0.25	3.5
Tyndall†	48	—10	20.2	1.50	15.0
Watertown	44	—23	14.2	0.10	1.0
Wentworth†	43	20	14.8	0.63	.....
Wessington Springs	48	—16	15.2	0.30	3.0
Tennessee.					
Andersonville	67	16	41.2	4.02	2.0
Ashwood*†[1]	79	23	42.8	6.35	1.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Benton (near) †	70	21	43.8	5.63	T.
Bluff City †	.....	.....	.....	3.77	T.
Bolivar †	76	22	41.4	7.17	4.7
Bristol †	63	11	38.6	3.94	T.
Byrdstown	68	15	41.3	6.07	9.3
Cagle	60	14	41.2	6.27	4.4
Carthage †	69	19	42.4	6.38	1.7
Charleston	.....	.....	.....	7.92	
Clarksville	69	28	41.0	3.69	3.8
Clinton †	.....	.....	.....	8.51	1.0
Covington	70	21	40.6	6.26	3.5
Decatur †	67	20	42.3	7.30	0.2
Dover	71	18	41.2	.....	2.0
Dyersburg	69	21	39.4	.....	3.0
Elizabethton †	68	17	41.3	3.23	0.5
Elk Valley	67	11	41.8	5.16	3.0
Erasmus	.....	.....	.....	6.59	6.6
Fairmount *[5]	56	12	40.0	8.77	T.
Florence †	67	19	42.0	6.09	4.8
Franklin	66	20	41.6	4.60	4.2
Grace *[5]	62	16	42.4	5.91	2.0
Greeneville †	68	13	41.4	4.15	2.0
Harriman	65	18	40.9	4.90	1.0
Hickory Withe	69	23	42.2	5.77	4.5
Hohenwald †	.....	20	.....	7.13	6.0
Jackson †	70	23	42.1	6.12	5.0
Johnsonville †	70	19	41.5	3.65	4.5
Jonesboro *[1]	64	16	40.2	4.26	4.0
Kingston †	.....	.....	.....	5.99	1.0
Liberty †	68	19	42.5	5.30	T.
Lynnville †	65	23	42.6	7.63	2.0
McKenzie †	68	20	40.6	4.21	2.4
McMinnville †	66	19	42.7	5.20	T.
Maryville	.....	.....	.....	6.44	2.0
Molino †	65	22	43.6	8.30	T.
Newmarket *[5]	67	19	41.0	.....	2.0
Newport †	67	17	42.0	4.35	0.5
Nunnelly	67	18	41.4	4.31	3.6
Oak Hill *[1]	66	16	42.4	6.27	4.5
Palmetto †	68	21	44.6	6.92	2.5
Pope	70	20	42.3	5.89	4.3
Rogersville †	66	15	40.6	4.30	2.0
Rugby	.....	12	.....	6.44	6.8
St. Joseph †	68	22	43.4	10.97	3.5
Savannah	69	23	42.6	5.93	1.6
Sewanee †	61	16	40.4	8.06	0.3
Silver Lake	.....	.....	.....	4.29	7.0
Springdale *[1]	65	16	39.9	4.25	2.3
Springfield	69	18	41.1	.....	4.0
Sylvia	68	18	40.6	5.91	7.0
Tazewell	.....	.....	.....	4.80	2.0
Tellico Plains †	70	20	43.6	5.66	T.
Tracy City	62	18	40.4	7.43	3.0
Trenton	68	21	39.0	4.17	2.3
Tullahoma †	64	20	42.0	6.30	2.0
Union City †	67	20	38.8	3.78	3.3
Waynesboro	68	22	42.2	7.24	5.1
Wildersville	68	21	40.8	6.08	6.5
Texas.					
Albany	76	12	43.4	0.68	
Arthur City †	.....	.....	.....	2.87	
Austin *a*	75	31°	48.4	2.67	
Austin *b* *[5]	78	21	45.7	.....	
Ballinger †	77	10	42.0	1.03	
Beeville †	82	28	51.4	1.67	
Blanco †	76	23	48.4	1.88	
Boerne *[1]	75	24	47.5	2.29	
Brazoria †	77	27	51.4	4.93	
Brenham †	76	24	49.0	.....	
Brighton	.....	.....	.....	0.98	
Brownwood	77	15	43.4	0.50	
Burnet *[1]	74	20	44.2	2.02	
Camp Eagle Pass †	78	25	48.9	0.82	
Childress	73	7	39.3	T.	
Coleman	81	11	44.3	0.30	
College Station	75	23	51.3	3.61	
Colmesneil	.....	.....	.....	11.02	
Columbia †	79	26	50.9	5.69	
Conroe	78	24	48.8	6.49	
Corsicana *b* †	81	16	44.5	2.63	
Cuero †	70	29	48.0	1.82	
Dallas †	78	13	41.8	2.90	
Danevang †	77	27	49.6	5.52	
Dublin †	75	12	42.7	1.30	
Duval *[1]	79	27	50.3	.....	
Emory	78	22	45.8	4.18	
Estelle †	76	9	41.4	2.14	T.
Forestburg †	72	11	42.0	1.00	.....
Fort Brown	82	30	56.6	0.71	
Fort McIntosh	85	25	53.5	1.30	
Fort Ringgold †	85	26	55.7	0.36	
Fort Stockton	.....	.....	.....	T.	
Fredericksburg *† [1]	75	23	45.2	1.42	
Fruitland	74	10	41.8	0.70	T.
Gainesville	73	12	42.5	1.98	
Georgetown *[1]	80°	24	45.8°	1.65	
Golindo	.....	.....	.....	1.55	
Grapevine	75°	13°	41.4[f]	1.97[d]	1.0
Hale Center †	74	12	41.6	0.08	0.8
Hallettsville †	78	28	50.4	1.46	
Haskell	83	9	41.1	0.35	2.0
Hewitt	.....	.....	.....	2.70	
Houston †	76	27	50.8	4.78	
Huntsville †	77	22	47.5	4.25	
Jacksonville	75	19	48.2	6.22	T.
Junction City	.....	.....	.....	0.80	
Kent	.....	.....	.....	0.00	
Kerrville	79	19	44.6	1.03	
Lampasas †	79	18	45.1	2.15	
Llano *† [5]	76	23	46.0	1.55	
Longview †	75	16	46.9	7.02	
Luling †	78	27	49.6	2.62	
Marshall	81	18	49.0	7.66	
Menardville	82	12	42.7	0.25	
Mount Blanco †	76	7	41.2	0.30	
New Braunfels †	76	29	49.4	1.84	
Panter	.....	.....	.....	2.35	T.
Point Isabel *[1]	82	40	60.5	0.07	
Rheinland †	78	8	39.8	.....	.....
Roby	78	10	41.2	0.69	2.0
Rocksprings	.....	.....	.....	0.00	
Runge †	84	30	54.8	1.39	
San Antonio	80	30	52.0	1.22	
San Marcos *b* †	77	25	47.9	2.37	
Sulphur Springs † [g]	79	15	45.0	3.33	
Temple *a*	77	18	44.6	2.67	
Tyler	73	11	44.6	3.73	
Valentine †	.....	.....	.....	0.60	6.0
Victoria	.....	.....	.....	2.60	
Waco †	77	17	45.1	2.33	
Waxahachie †	74	15	41.2	.....	.....
Weatherford †	76	13	42.4	2.03	.....
Wichita Falls †	.....	.....	.....	1.37	.....
Utah.					
Alpine City †	.....	.....	.....	1.27	4.5
Blue Creek *[8]	45	−2	24.8	0.15	1.5
Brigham City †	.....	.....	.....	1.16	.....
Cisco †	49	−18	11.2	1.32	10.2
Corinne	44	−4	24.8	0.29	0.5
Ferron	56	−10	26.2	1.10	11.0
Fillmore †	50	−14	19.8	1.55	.....
Fort Duchesne †	36	−18[8]	6.7[f]	1.20	12.0
Frisco	55	−2	29.0	1.00	10.0
Giles †	45	2	24.6	.....	.....
Heber	38[g]	−16[g]	14.8[d]	.....	.....
Huntsville	.....	.....	.....	2.80	14.0
Kelton *[8]	40	0	24.4	.....	.....
Levan †	48	−8	21.6	1.65	16.5
Loa †	52	−19	21.4	0.06	0.6
Logan †	46	−6	24.5	1.22	.....
Millville	.....	.....	.....	1.03	.....
Minersville	45	−8	21.4	1.52	15.0
Moab †	46	−9	21.6	1.65	11.0
Mount Pleasant †	51	−8	24.3	1.90	19.0
Ogden *a* *[8]	50	8	27.7	2.25	7.7
Ogden *b*	55	1	30.2	1.89	3.8
Pahreah	51	−4	29.5	0.50	3.0
Parowan †	49	−10	24.8	0.88	8.8
Pinto	68	−19	24.5	1.16	16.2
Promontory	41	−10	21.0	0.55	4.0
Provo	56	−1	28.4	1.04	.....
Richfield †	60	0	29.2	0.40	4.0
St. George †	58	2	32.4	0.45	5.5
Scipio †	48	−19	19.9	1.49	16.0
Snowville	39	−6	21.4	0.70	3.0
Soldier Summit †	42	−16	15.6	2.50	25.0
Terrace *[8]	38	−5	21.2	0.15	1.5
Thistle	59	−13	22.0	1.35	13.5
Tooele †	49	5	27.3	1.93	.....
Vernal	42	−14	13.6	1.20	11.0
Vermont.					
Brattleboro	57	−5	27.0	6.93	21.8
Burlington †	56	0	27.4	2.10	4.0
Chelsea †	52	−7	22.0	3.35	10.0
Cornwall	55	−8	24.7	3.41	6.5
Enosburg Falls	56	−18	24.0	3.93	15.5
Hartland †	54	−6	23.6	4.41	13.8
Jacksonville	50	−8	21.4	7.23	27.8
St. Johnsbury	49	−12	21.7	3.90	8.2
Vernon *[8]	56	−9	26.8	7.36	21.0
Wells	56	−6	24.6	3.33	7.0
Woodstock	57	−6	24.7	3.54	13.0
Virginia.					
Alexandria	64	12	37.1	3.43	.....
Ashland †	74	13	41.9	2.67	
Barboursville	68	12	38.6	3.92	0.5
Bedford City	70	14	40.2	3.55	
Bigstone Gap †	64	16	39.1	4.77	2.5
Birdsnest *† [1]	70	20	43.9	3.60	
Blacksburg	65	9	35.9	3.67	5.0
Buckingham †	70	11	39.1	2.77	
Burkes Garden	.....	.....	.....	4.81	8.0
Callaville †	66	14	42.3	2.45	
Christiansburg	.....	.....	.....	3.66	2.0
Clarksville	.....	.....	.....	2.45	
Clifton Forge	61	16	37.1	3.54	6.0
Dale Enterprise †	68	5	36.4	3.23	5.5
Doswell	67	10	38.8	2.80	
Dwale	.....	.....	.....	2.90	2.6
Farmville	69	20	40.3	1.91	
Fredericksburg †	68	12	38.8	3.17	1.0
Grahams Forge	63	10	36.6	4.39	3.2
Hampton	68	22	45.1	3.27	
Hot Springs	65	6	38.3	3.98	12.0
Leesburg	.....	.....	.....	2.42	2.0
Lexington †	71	11	39.0	3.42	1.5
Maidens	.....	.....	.....	2.36	
Manassas †	69	10	38.2	3.33	1.5
Marion †	62	9	38.4[d]	4.08	6.0
Monterey	56	2	37.5	3.38	6.0
Nottoway	69	12	42.4	3.21	
Petersburg †	70	16	43.1	2.66	T.
Richmond (near) †	66	12	41.2	4.01	T.
Rockymount †	68	14	41.6	3.80	
Salem †	71	16	42.2	3.82	1.8
Speers Ferry	.....	.....	.....	5.22	T.
Spottsville †	74	15	42.9	3.23	
Stanardsville †	70	9	37.2	4.40	1.0
Staunton †	68	12	39.6	3.31	3.0
Stephens City †	68	8	36.3	3.87	5.0
Sunbeam †	65	16	41.5	3.40	
Warrenton	63	16	38.9	2.80	0.5
Warsaw †	65	11	39.6	2.94	T.
Westbrook Farm	65	15	41.2	.....	.....
Woodstock †	64	6	36.6	3.72	8.5
Wytheville †	66	12	38.5	4.13	4.0
Washington.					
Aberdeen	58	31	42.6	18.66	
Anacortes	.....	.....	.....	5.67	
Ashford †	.....	.....	.....	17.31	2.0
Blaine †	53	12	34.1	7.69	1.2
Bridgeport	44	−5	22.4	1.70	17.0
Cascade Tunnel	49	10	28.4	17.43	124.0
Centerville †	55	15	30.8	4.74	3.0
Chehalis †	56	29	41.2	14.27	
Clearwater	.....	30	.....	23.66	
Coupeville †	52	25	40.7	3.97	T.
Dayton	61	7	34.3	2.76	2.5
Ellensburg	47	4	25.0	2.93	.....
Ellensburg (near)	40	6	24.0	5.40	10.0
Fort Simcoe †	57	2	29.0	4.75	10.0
Fort Spokane	46	0	25.2	2.12	21.8
Grandmound †	55	27	41.0	16.59	T.
Hunters †	44	0	22.3	2.52	16.7
Kennewick †	63	8	35.7	1.21	T.
La Center	57	21	40.9	12.09	0.2
Lakeside	50	7	25.7	3.37	30.5
Lind	52	2	31.0	1.64	0.4
Loomis †	45	3	25.7	1.48	19.0
Madrone †	56	28	40.8	13.92	
Mayfield †	55	26	41.4	12.83	
Moxee Valley †	55	4	30.4	2.07	13.8
New Whatcom	57	21	40.8	6.07	2.0
Northbend	57	26	39.8	22.62	T.
Olga	53	29	41.0	7.32	
Olympia †	56	28	42.7	17.60	
Pinehill †	53	20	33.7	7.82	6.4
Pomeroy	54	14	33.5	2.54	4.0
Port Townsend	55	31	42.4	3.66	
Pullman †	50	9	30.8	3.74	5.0
Rosalia †	47	−1	28.8	3.90	3.8
Sedro †	60	25	41.0	5.90	1.5
Shoalwater Bay *[10]	53	33	44.2	.....	.....
Snohomish †	55	30	42.0	10.58	0.5
Southbend	59	30	43.3	20.70	
Stampede	41[j]	13	29.8°	12.09	44.0
Sunnyside †	57	12	32.2	1.61	0.5
Union City †	54	27	41.8	29.20	
Vashon †	55	30	41.6	15.17	
Waterville †	43	−12	19.0	4.08	33.5
West Virginia.					
Beckley	.....	.....	.....	2.43	3.5
Beverly †	64	−4	37.6	6.03	13.0
Bluefield †	64	6	39.1	3.50	4.7
Buckhannon *a* †	.....	.....	.....	6.76	12.0
Buckhannon *b*	64	1	37.1	.....	.....
Burlington †	69	3	36.4	3.27	0.5
Charleston †	.....	.....	.....	3.97	3.0
Dayton †	64	2	37.4	4.87	5.0
Eastbank	65	10	41.2	6.05	2.0
Elkhorn †	65	11	40.9	4.48	8.2
Fairmont †	.....	.....	.....	4.63	2.0
Glenville †	65	6	37.0	4.53	3.0
Grafton †	67	2	35.6	4.96	7.2
Green Sulphur	63	10	37.7	2.88	5.0
Harpers Ferry †	.....	.....	.....	3.90	0.7
Hinton *a* †	.....	.....	.....	3.76	4.0
Hinton *b* †	64	10	36.6	.....	4.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Huntington	67	12	37.6	2.69	1.0
Kingwood	59	0	32.9*	5.60	.....
Marlinton†	67	4	33.9	4.64	4.0
Martinsburg†	69	9	36.1	3.10	2.0
Morgantown *b*†	68	3	38.1	2.77	2.5
New Martinsville†	70	5	36.7	4.39	5.5
Nuttallburg	72	.....	.....	4.65	.....
Oldfields†	67	4	35.8	2.52	2.0
Point Pleasant†	69	10	37.8	3.42	T.
Powellton	66	0	40.8	4.33	6.1
Romney	65	8	35.8	2.49	.....
Rowlesburg†	.....	.....	.....	7.24	4.0
Upper Tract	69	.....	.....	2.05	2.5
Weston *a*	.....	.....	.....	5.26	3.0
Weston *b**†	66	7	38.2	... ...	5.0
Wheeling *a*†	....	.....	.....	3.18	6.5
Wheeling *b*†	64	9	38.0	3.79	8.5
Wisconsin.					
Amherst	50	−17	15.2	0.82	7.2
Bayfield	40	−12	16.5	1.20	12.0
Beloit	49	−11	19.4	1.25	7.7
Brodhead	49	−18	18.2	1.89	8.0
Chilton	47	−18	16.4	1.87	20.5
Citypoint	47	−17	15.0	0.75	7.5
Delavan	52	−16	18.1	1.35	7.8
Dodgeville†	44	−12	16.7	1.92	12.7
Easton	47	−22	15.0	0.56	5.5
Eau Claire	40	−17	13.6	0.72	6.0
Florence†	43	−17	15.0	0.35	4.0
Fond du Lac	44	−16	17.0	1.40	14.0
Grand River Locks	.....	....	.....	1.86	18.5
Grantsburg†	49	−19	13.8	0.35	3.5
Gratiot	48	−17	18.1	2.55	12.5
Hartford	.....	.....	.....	2.22	12.5
Hartland	50	−10	19.3	1.97	10.5
Harvey	46	−10	18.8	1.61	8.2
Hayward	51	−20	13.0	0.41	4.1
Hillsboro	47	−20	16.2	1.86	17.5
Kenosha *10	46	−10	17.4	.....	.....
Koepenick *†[1]	52	−18	15.2	0.60	6.0
Lancaster†	42°	−12°	16.0°	1.05	11.4
Lincoln†	43	−10	20.2	1.25	9.0
Madison†	40	− 7	18.4	1.67	9.6
Manitowoc†	43	− 7	19.8	1.39	14.4
Meadow Valley†	45	−18	14.2	1.10	16.0
Medford †	50	−22	12.7	0.40	4.0
Neillsville†	36	−20	13.1	0.81	8.0
New London	44	..12	16.4	1.06	10.0
North Crandon	47	−20	10.6	0.52	5.2
Oconto	48	− 9	19.2	1.07	10.5
Osceola†	49	−29	10.8	0.11	1.5
Oshkosh	50	−11	22.4	0.71	7.0
Pepin	40	−22	12.8	0.44	5.0
Pine River†	49	−14	17.8	1.03	11.8
Portage†	42	−12	15.0	1.61	17.0
Port Washington	49	−10	22.1	1.81	... ...
Prairie du Chien	47	−12	20.7	1.47	11.8
Racine	53	− 7	22.5	1.35	8.0
Sharon	53	−11	17.2	1.07	8.5
Shawano	47	−10	18.6	0.99	13.3
Sheboygan *10	52	− 8	26.4	.....	.....
Spooner	48	−22	10.4	0.10	1.0
Stevens Point†	48	−15	15.8	1.02	11.6
Sturgeon Bay Canal *9	42	− 8	19.6	.....	.....
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Valley Junction†	48	−20	15.8	0.91	10.3
Viroqua	44	−12	17.7	1.71	15.5
Watertown†	47	−11	17.6	2.69	15.2
Waukesha†	48	− 5	21.1	1.58	10.4
Waupaca†	42	−16	16.5	0.77	11.5
Wausau †	40	−16	14.6	0.86	9.0
Westbend	46	− 4	20.4	1.43	9.3
Westfield †	42	−12	17.2	1.39	11.9
White Mound †	50	−17	17.2	1.20	12.0
Wyoming.					
Atlantic City	44	−18	15.5	1.42	14.2
Big Horn Ranch	52	−19	22.9	0.75	7.5
Carbon	53	−15	19.8	1.14	.....
Fort Laramie†	56	−13	27.1	0.78	6.8
Fort Washakie	53	−30	18.2	2.14	21.4
Fort Yellowstone†	37	−19	19.0	0.80	8.0
Green River	49	−17	18.3	0.90	9.0
Laramie	43	−24	15.0	0.77	13.0
Lovell	54°	−22°	16.8°	0.11	2.0
Lusk†	55	−14	22.2	0.24	.....
Sheridan	56	−33	19.6	0.60	6.0
Sundance	46	−21	18.8	1.30	13.0
Wamsutter	48	−26	10.1	0.80	8.0
Wheatland	70	−14	28.2	0.50	5.0
Mexico.					
Ciudad P. Diaz	80	32	51.4	1.08	
Leon de Aldamas	75	28	61.3	T.	
Puebla	76	20	56.0	0.08	
Topolobampo*[1]	78	49	65.2	0.00	
New Brunswick.					
St. John	53	4	26.5	3.72	6.0
West Indies.					
Grand Turk Island	.....	.....	.....	0.77	
New Hampshire.	°	°	°	*Ins.*	*Ins.*
Bethlehem	58	1	31.2	5.62	12.5
New Jersey.					
Junction	.....	.....	.....	6.67	2.6
North Carolina.					
Mountairy	75	18	46.8	2.36	
Oregon.					
Riverside	72	9	37.6	1.86	4.0
Tillamook Rock	.....	.....	.....	9.39	
South Dakota.					
Rochford	.....	−11	29.8	.....	.....
Texas.					
San Antonio	87	36	63.6	0.46	
Wyoming.					
Laramie	.....	.....	.....	0.33	.....

Late reports for November, 1897.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.					
Killisnoo	49	14	29.0	4.25	2.0
Arkansas.					
Hot Springs *a*	.....	.....	.....	5.29	
Colorado.					
Walden	60	− 4	27.8	0.45	4.5
Florida.					
Macclenny	.....	.....	.....	1.47	
Idaho.					
Marysville	62	− 6	30.6	2.12	11.0
Kansas.					
Augusta	82	7	45.2	0.05	
Eureka	.....	.....	.....	0.12	
Hays	85	4	44.6	T.	T.
Independence	79	9	46.2	0.66	
Massachusetts.					
Concord	68	5	37.4	5.81	5.7
Minnesota.					
Lawrence	60	9	31.7	.....	.....
Mississippi.					
Thornton	80	30	59.2	4.30	
Missouri.					
Warrensburg[1]	.....	.....	46.1	1.46	
Montana.					
Choteau	77	−25	22.8	2.00	20.0
Kalispell	59	0	28.0	5.17	18.5

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

† Weather Bureau instruments.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "^{4} $_{8}$" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

California, October, 1897, Bodie, make precipitation read 1.56. Bowmans Dam, make precipitation read 4.04. Edmanton, make precipitation read 3.78. Fordyce Dam, make precipitation read 4.95. Laporte, make precipitation read 4.84. Summerdale, make precipitation read 5.02. Susanville, make precipitation read 2.45.

Oregon, Bandon, November, 1897, make mean temperature read 48.6.

November REVIEW, page 484, table of Mexican data, Torreon (Coahuila), altitude, for 8,720 read 3,720.

Page 211, line 31 from bottom, for "interrupted" read "interpreted."

TABLE III.—*Data from Canadian stations for the month of December, 1897.*

Stations.	Pressure.			Temperature.		Precipitation.		Prevailing direction of wind.	Total depth of snow.
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Total.	Departure from normal.		
	Inches.	*Inches.*	*Inches.*	°	°	*Inches*	*Inches.*		
St. Johns, N. F. ..	29.56	29.71	— .13	29.4	+ 0.7	5.07	.....	n.	22.0
Sydney, C. B. I.....	29.88	29.94	+ .06	29.4	+ 1.2	2.54	— 2.18	nw.	10.0
Halifax, N. S	29.88	30.02	+ .07	29.4	+ 1.8	3.53	— 1.76	nw.	1.9
Grand Manan, N. B.	29.94	29.99	.00	29.0	+ 0.7	3.21	— 1.46	w.	5.1
Yarmouth, N. S. ...	29.94	30.02	+ .04	32.1	+ 1.4	2.08	— 3.19	nw.	5.7
Charlottet'n, P. E. I.	29.90	29.94	+ .02	26.2	+ 1.9	2.47	— 1.53	nw.	6.5
Chatham, N. B	29.93	29.95	+ .01	19.0	+ 2.0	3.39	+ 0.42	w.	19.6
Father Point, Que..	29.96	29.99	+ .04	16.6	+ 1.2	3.05	+ 0.83	w.	18.4
Quebec, Que.....	29.67	30.02	+ .01	16.4	+ 1.2	2.37	— 1.94	ne.	12.2
Montreal, Que	29.80	30.02	— .01	19.2	+ 0.9	5.94	+ 2.38	sw.	39.1
Rockliffe, Ont.....	29.47	30.02	— .01	13.4	— 1.8	4.43	+ 1.69	se.	32.3
Kingston, Ont	29.70	30.04	— .01	25.0	+ 1.3	3.32	— 0.32	w.	....
Toronto, Ont	29.64	30.04	— .02	27.8	+ 0.8	3.68	+ 1.14	sw.	13.3
White River, Ont ..	28.60	30.06	+ .01	3.6	— 6.1	0.92	— 0.52	w.	9.2
Port Stanley, Ont ..	29.38	30.05	— .02	28.0	— 0.4	2.45	— 0.16	w.	12.0
Saugeen, Ont	29.36	30.01	— .01	27.2	+ 0.5	4.77	+ 0.64	nw.	34.3
Parry Sound, Ont..	29.36	30.00	— .03	21.4	+ 0.2	6.30	+ 2.37	e.	46.8
Port Arthur, Ont ..	29.28	30.03	+ .01	10.5	— 2.7	0.46	— 0.39	nw.	4.6
Winnipeg, Man	29.14	30.04	— .06	3.0	— 1.1	0.55	— 0.64	w.	5.4
Minnedosa, Man ...	28.99	30.05	— .05	3.6	— 2.1	0.94	+ 0.21	w.	9.3
Qu'Appelle, Assin..	27.62	30.05	— .07	5.8	— 1.6	0.43	— 0.21	nw.	4.3
Medicine Hat, Assin	27.64	30.07	— .03	18.0	— 0.2	0.43	+ 0.07	s.	4.2
Swift Curr't, Assin.	27.34	30.08	— .04	14.2	— 1.8	0.89	+ 0.18	w.	8.9
Calgary, Alberta...	26.31	30.02	— .10	17.8	— 0.4	0.70	— 0.08	w.	7.0
Prince Albert, Sask.	28.36	30.00	... .	4.2	+ 1.4	2.10	.....	nw.	21.0
Edmonton, Alberta.	27.55	30.02	+ .03	15.5	+ 2.4	1.04	+ 0.64	w.	5.4
Battleford, Sask ...	28.16	30.04	.....	4.4	— 1.0	0.50	.....	se.	4.0
Kamloops, B. C.....	.....	.....	.....	.....	.....	1.23	.....	.....	10.0
Hamilton, Bermuda	30.00	30.16	+ .04	65.8	+ 1.1	3.86	..... .	e.	
Banff, Alberta.....	25.28	30.14	... .	15.9	.....	0.98	.....	sw.	6.2
Esquimalt, B. C.....	30.01	30.04	.....	40.8	— 0.5	10.85	.....	n.	0.0
Ottawa, Ont	29.60	30.07	.....	16.6	— 0.4	4.13	....	w.	...
November, 1897.									
Calgary, Alberta...	26.38	30.15	+ .11	10.6	—15.2	2.54	+ 2.19	w.	....

TABLE IV not received.

TABLE V.—*Mean temperature for each hour of seventy-fifth meridian time, December*, 1897.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N Dak.....	12.1	11.1	10.5	10.0	9.6	9.0	8.4	8.3	7.9	8.0	10.3	13.0	15.8	18.2	19.9	21.4	21.8	20.3	18.1	16.6	15.1	14.6	14.4	13.4	13.7
Boston, Mass.	32.9	32.7	32.2	32.0	31.8	31.4	31.2	31.1	31.5	32.5	34.2	35.4	36.4	37.0	37.0	36.6	36.3	35.7	34.9	34.4	34.0	33.6	33.6	33.3	33.8
Buffalo, N. Y.....	29.5	29.5	29.5	29.5	29.3	29.2	29.5	29.6	30.5	31.2	32.1	32.6	33.2	33.5	33.5	33.2	32.8	32.1	31.8	31.5	30.8	30.1	29.8	29.5	31.0
Chicago, Ill.....	24.6	24.5	24.5	24.3	23.8	23.1	22.9	23.4	23.4	23.9	24.6	25.5	26.2	27.0	27.7	27.7	27.7	27.0	26.7	26.5	25.6	25.3	25.0	24.6	25.2
Cincinnati, Ohio.....	35.4	35.1	34.6	34.4	34.2	34.0	33.5	33.7	33.6	34.3	35.4	37.0	37.9	38.9	39.2	39.3	39.0	38.2	37.8	37.5	36.9	36.4	35.6	35.4	36.1
Cleveland, Ohio	30.6	30.6	30.1	29.6	29.8	29.9	30.0	30.0	29.9	30.6	31.7	32.4	33.2	33.7	34.0	33.9	33.5	33.2	32.6	32.2	31.5	31.2	30.6	30.5	31.5
Detroit, Mich.....	27.0	27.0	26.6	26.4	26.1	26.2	26.1	26.2	26.5	27.5	28.8	29.5	30.2	30.3	30.5	30.4	30.1	29.6	28.8	28.8	27.9	27.7	27.1	26.8	28.0
Dodge City, Kans.....	25.6	25.0	24.6	23.9	23.5	23.0	22.5	22.4	22.0	23.3	29.0	33.5	36.4	38.5	39.5	40.2	40.4	39.5	35.4	31.3	29.4	28.2	26.9	26.5	29.6
Eastport, Me.....	25.8	25.8	25.8	25.9	25.6	25.5	25.2	25.2	25.7	26.5	27.7	28.7	29.3	29.6	29.6	29.5	29 0	28.4	28.2	28 0	27.5	27.4	27.0	26.7	27.2
Galveston, Tex.....	54.6	54.2	53.9	53.7	53.5	53.0	52.7	52.2	52.0	52.2	53.4	54.5	55.6	56.3	56.9	57.3	57.2	57.0	56.2	55.9	55.5	55.1	55.0	54.6	54.7
Havre, Mont.....	16.7	16.8	17.1	17.3	17.9	17.6	16.9	16.7	16.0	15.7	16.1	17.3	18.8	20.5	21.1	21.5	22.5	22.9	21.6	20.2	19.8	18.8	18.5	17.8	18.6
Kansas City, Mo.....	26.0	25.7	25.8	25.4	25.2	25.1	24.8	25.2	25.0	25.5	26.7	28.2	29.5	30.8	32.1	33.1	33.0	32.3	31.1	29.2	28.2	27.5	26.7	26.1	27.8
Key West, Fla.....	71.2	71.0	71.0	71.0	70.8	71.0	70.6	71.0	72.2	73.0	73.5	73.8	74.5	74.6	74.8	74.3	73.5	72.4	72.2	72.3	71.7	71.5	71.4	71.5	72.3
Memphis, Tenn.....	40.3	39.7	39.3	39.2	39.3	38.6	37.8	37.8	37.5	38.5	39.5	41.2	42.4	43.6	44.7	45.4	45.5	44.9	44.0	43.5	42.6	41.9	41.2	40.6	41.2
New Orleans, La.....	54.6	54.4	54.2	53.9	53.7	53.6	53.4	53.4	54.3	55.8	58.1	59.9	61.2	62.3	62.6	62.6	62.1	60.7	59.2	58.0	56.4	55.4	54.7	54.4	57.0
New York, N. Y.....	34.2	33.8	33.4	33.1	33.0	32.6	32.6	32.7	33.0	34.0	35.0	36.2	36.9	37.2	37.8	37.8	37.4	36.8	36.4	36.4	35.7	35.6	35.2	34.8	35.1
Philadelphia, Pa.....	36.5	36.1	35.5	34.8	34.4	34.3	34.4	34.6	35.0	36.3	37.9	39.8	41.0	41.7	42.1	41.8	41.2	40.0	39.0	38.7	38.0	37.6	37.1	36.9	37.7
Pittsburg, Pa.....	35.3	35.0	34.6	34.3	34.1	34.1	34.1	34.5	34.7	36.0	37.0	38.0	39.1	39.6	40.0	39.6	39.2	38.8	38.1	37.6	37.1	36.5	36.2	36.0	96.6
Portland, Oreg.....	42.5	42.3	42.2	41.9	41.8	41.5	41.4	41.6	41.3	41.1	40.9	41.0	42.0	43.0	44.5	44.8	45 0	44.9	44.1	43.4	43.4	43.4	43.3	43.0	42.7
St. Louis, Mo.....	32.3	32.0	31.6	31.1	30.6	30.3	29.7	29.8	29.8	30.5	31.4	32.4	33.6	35.0	35.3	35.7	35.5	34.8	34.3	33.9	33.7	33.1	32.6	32.0	32.5
St. Paul, Minn.....	14.3	13.8	13.2	12.8	12.3	12.2	11.6	11.8	11.1	11.1	12.3	13.8	15.6	17.5	18.8	19.6	19.8	19.1	18.0	17.5	16.7	15.9	15.3	14.6	14.9
Salt Lake City, Utah..	25.8	25.5	25.4	24.4	24.2	23.9	24.5	24.9	23.8	23.5	24.6	26.9	28.5	30.2	31.8	32.9	33.2	32.7	31.2	29.3	27.8	26.9	26.0	25.4	27.2
San Diego, Cal.....	51.4	51.1	49.9	49.5	49.0	48.6	47.9	47.7	47.5	47.5	49.2	51.6	58.4	61.0	61.7	61.8	61.7	60.8	59.9	58.2	56.5	54.7	53.2	52.1	53.9
San Francisco, Cal....	50.1	49.7	49.2	48.6	48.0	47.7	47.3	47.1	46.6	46.1	46.0	46.8	48.5	50.4	51.7	53.4	54.9	55.5	55.0	53.5	52.8	52.1	51.3	50.7	50.1
Savannah, Ga.....	50.5	49.4	48.9	48.6	48.1	47.5	47.5	47.8	49.5	53.0	55.8	58.3	59.5	60.4	61.0	60.7	58.8	56.6	55.2	54.1	53.2	52.5	51.9	51.2	53.3
Washington, D. C....	35.7	35.5	34.6	34.2	33.7	33.4	33.5	34.1	35.4	37.1	39.2	40.9	42.3	43.7	44.1	43.5	42.2	41.1	39.6	39.0	37.9	37.2	36.6	36.1	37.9

TABLE VI.—*Mean pressure for each hour of seventy-fifth meridian time, December*, 1897.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak...	28.245	.243	.243	.244	.246	.245	.247	.246	.243	.241	.247	.253	.243	.229	.215	.207	.210	.218	.226	.229	.233	.237	.241	.245	.237
Boston, Mass.....	29.907	.910	.908	.905	.908	.916	.928	.936	.942	.944	.929	.909	.895	.891	.894	.894	.897	.902	.901	.898	.896	.895	.887	.877	.907
Buffalo, N. Y.....	29.192	.189	.190	.183	.177	.178	.185	.183	.188	.191	.185	.170	.156	.145	.146	.150	.162	.171	.181	.186	.188	.192	.193	.188	.178
Chicago, Ill.	29.151	.146	.145	.143	.145	.147	.158	.170	.173	.183	.184	.183	.169	.154	.156	.160	.165	.173	.174	.172	.175	.173	.172	.167	.164
Cincinnati, Ohio ...	29.422	.417	.421	.418	.415	.419	.429	.434	.447	.458	.460	.446	.423	.414	.409	.413	.418	.427	.433	.435	.438	.438	.439	.434	.430
Cleveland, Ohio	29.214	.213	.217	.212	.210	.209	.218	.220	.228	.232	.230	.213	.194	.183	.186	.195	.203	.208	.216	.224	.228	.225	.225	.221	.214
Detroit, Mich.....	29.242	.240	.242	.239	.232	.231	.239	.243	.250	.253	.255	.245	.228	.222	.223	.228	.239	.246	.254	.263	.264	.263	.259	.256	.244
Dodge City, Kans..	27.478	.473	.465	.467	.466	.461	.463	.467	.470	.473	.482	.486	.468	.447	.438	.438	.438	.447	.459	.480	.486	.488	.493	.496	.468
Eastport, Me.....	29.891	.893	.892	.888	.888	.898	.911	.926	.935	.934	.918	.906	.896	.893	.899	.902	.903	.905	.906	.907	.902	.895	.883	.874	.902
Galveston, Tex.....	30.095	.091	.088	.083	.083	.088	.098	.107	.124	.128	.131	.126	.104	.080	.066	.063	.066	.072	.079	.090	.098	.105	.111	.116	.096
Havre, Mont.....	27.333	.330	.327	.325	.328	.328	.325	.326	.332	.336	.345	.354	.360	.350	.339	.329	.328	.331	.335	.338	.336	.338	.339	.340	.336
Kansas City, Mo....	29.101	.099	.095	.097	.096	.094	.095	.099	.108	.117	.129	.129	.106	.087	.073	.072	.081	.087	.096	.106	.117	.118	.121	.122	.102
Key West, Fla.....	30.118	.108	.101	.098	.098	.105	.118	.134	.151	.159	.151	.133	.107	.090	.085	.082	.088	.095	.108	.120	.131	.136	.135	.129	.116
Memphis, Tenn.....	29.702	.699	.697	.698	.694	.696	.700	.706	.715	.726	.736	.735	.707	.687	.673	.672	.682	.688	.697	.705	.714	.716	.719	.720	.704
New Orleans, La....	30.096	.090	.087	.085	.084	.087	.098	.113	.130	.140	.141	.125	.096	.074	.063	.062	.065	.066	.073	.085	.098	.109	.114	.113	.096
New York, N. Y....	29.739	.740	.740	.736	.737	.744	.755	.764	.772	.775	.759	.734	.710	.698	.694	.699	.703	.706	.709	.712	.714	.718	.716	.715	.729
Philadelphia, Pa....	29.978	.981	.983	.984	.984	.989	.993	.004	.014	.015	.001	.978	.959	.945	.941	.943	.946	.948	.954	.955	.964	.965	.961	.957	.973
Pittsburg, Pa.....	29.175	.174	.175	.167	.165	.168	.171	.169	.174	.179	.174	.158	.144	.137	.137	.144	.155	.159	.169	.175	.173	.172	.171	.170	.165
Portland, Oreg.....	29.980	.983	.982	.981	.977	.978	.971	.965	.964	.967	.966	.975	.986	.991	.975	.965	.955	.955	.957	.956	.959	.962	.967	.975	.971
St. Louis, Mo.....	29.492	.487	.493	.495	.493	.495	.505	.513	.521	.530	.537	.525	.503	.485	.478	.482	.487	.491	.499	.503	.507	.509	.511	.514	.502
St. Paul, Minn.....	29.129	.133	.141	.149	.149	.150	.157	.160	.163	.173	.182	.185	.166	.149	.137	.128	.131	.132	.136	.139	.140	.135	.134	.139	.147
Salt Lake City, Utah	25.789	.793	.789	.789	.792	.785	.784	.787	.793	.798	.809	.822	.827	.813	.795	.787	.785	.790	.794	.801	.801	.804	.801	.805	.797
San Diego, Cal.....	30.053	.052	.050	.047	.046	.041	.034	.037	.043	.055	.067	.084	.086	.071	.043	.022	.012	.008	.007	.012	.024	.036	.044	.049	.043
San Francisco, Cal..	30.075	.078	.081	.075	.079	.080	.073	.074	.072	.081	.090	.105	.114	.105	.075	.058	.047	.044	.046	.047	.055	.062	.071	.073	.073
Savannah, Ga.....	30.077	.078	.073	.075	.072	.081	.091	.098	.111	.121	.115	.099	.071	.055	.047	.049	.052	.055	.065	.073	.075	.081	.080	.075	.078
Washington, D. C...	30.000	.002	.005	.000	.000	.007	.015	.021	.030	.037	.021	.997	.972	.962	.960	.964	.970	.979	.987	.990	.993	.995	.994	.988	.995

TABLE VII.—*Average wind movement for each hour of seventy-fifth meridian time, December, 1897.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	8.9	9.1	8.4	8.2	8.2	8.5	8.5	8.0	8.3	8.1	9.8	10.8	11.8	12.1	12.4	11.8	11.6	11.2	9.0	7.8	7.2	7.4	8.0	8.0	9.3
Albany, N. Y.	7.4	7.3	6.7	6.3	6.9	7.1	6.3	6.7	7.8	8.5	9.4	10.1	10.0	9.7	9.4	8.6	8.4	8.2	8.4	8.4	7.8	7.7	7.9	7.5	8.0
Alpena, Mich.	8.7	9.3	8.9	8.9	8.9	9.0	9.1	9.4	8.7	8.9	9.4	10.4	10.5	10.2	10.0	9.2	8.7	7.9	8.9	9.3	9.3	8.8	8.1	8.5	9.1
Amarillo, Tex.	13.9	13.9	13.1	12.8	13.3	13.9	14.0	13.1	12.3	12.6	13.0	13.5	14.7	15.3	16.4	16.6	15.7	14.5	12.3	12.6	12.5	12.9	14.0	13.6	13.8
Atlanta, Ga.	9.2	9.5	9.8	9.6	10.0	9.8	9.5	9.8	9.6	9.9	10.6	10.4	10.8	9.8	10.2	10.7	10.0	8.6	8.5	8.8	9.9	10.1	10.2	9.8	9.8
Atlantic City, N. J.	10.4	10.6	9.6	9.1	9.4	9.9	9.8	10.1	10.6	11.5	12.2	12.6	13.0	12.8	13.2	12.9	11.8	11.2	11.7	11.7	11.8	11.7	11.8	11.3	11.3
Augusta, Ga.	4.4	4.4	4.6	4.6	4.9	5.0	4.7	4.5	5.0	6.1	6.9	7.4	8.2	8.4	8.5	7.9	7.1	6.5	5.8	5.6	5.4	4.9	4.6	5.1	5.8
Baker City, Oreg.	5.6	5.8	5.8	5.4	5.5	5.4	5.6	5.5	5.2	5.2	6.0	6.5	7.0	7.3	6.9	6.5	6.5	5.5	5.2	4.8	5.1	4.9	6.1	6.3	5.8
Baltimore, Md.	3.7	4.0	4.1	3.9	4.1	4.1	3.9	3.9	4.6	5.4	6.4	6.5	6.0	5.8	6.0	6.0	5.5	4.9	4.2	4.5	4.4	4.0	3.9	4.1	4.7
Bismarck, N. Dak.	7.3	6.3	6.0	6.3	6.6	6.4	6.0	5.5	5.2	5.6	6.6	8.1	9.5	9.8	10.3	10.9	10.5	8.2	6.6	7.9	7.8	7.9	7.7	7.5	7.5
Block Island, R. I.	17.6	17.5	17.3	17.6	17.6	16.7	16.4	17.0	16.9	17.0	17.1	17.4	17.7	18.2	17.6	17.8	16.9	16.5	16.9	16.2	15.8	17.1	17.1	17.6	17.2
Boston, Mass.	10.9	11.1	11.1	11.4	11.3	10.9	11.3	11.0	11.5	12.3	12.8	12.5	12.4	12.6	12.9	12.3	11.8	11.7	11.6	11.0	11.4	11.0	11.2	10.9	11.6
Buffalo, N. Y.	16.0	16.0	15.2	14.5	15.8	15.8	16.2	16.7	17.3	18.0	18.1	18.2	19.4	19.7	19.5	18.5	19.5	18.3	19.1	19.3	18.3	17.6	17.3	16.4	17.5
Cairo, Ill.	8.9	8.5	8.5	8.0	7.9	7.5	7.6	8.3	8.4	8.8	9.9	10.5	10.6	10.5	10.2	9.6	9.1	8.7	9.4	9.3	9.5	9.6	9.7	9.2	9.1
Cape Henry, Va.	13.9	13.3	13.8	13.0	13.3	12.8	12.6	13.6	13.4	14.2	14.4	14.0	14.4	13.8	13.8	13.7	12.1	11.4	11.7	12.4	13.1	13.1	13.7	14.1	13.3
Carson City, Nev.	4.5	4.5	4.6	5.2	4.4	5.3	4.6	3.7	4.0	4.7	5.1	6.2	6.4	7.2	8.3	7.9	8.1	7.9	7.5	6.3	6.1	5.3	4.7	4.3	5.7
Charleston, S. C.	8.8	9.4	9.7	9.5	9.9	9.1	8.9	9.0	9.6	10.1	10.1	10.2	10.6	9.9	9.7	9.2	8.8	8.4	8.1	8.1	8.5	8.6	8.4	8.4	9.2
Charlotte, N. C.	5.8	6.2	6.1	6.4	6.4	5.9	5.2	5.6	6.1	7.0	7.6	7.0	7.5	7.7	8.2	7.8	6.8	6.4	5.9	6.7	7.1	7.8	7.1	6.4	6.7
Chattanooga, Tenn.	7.9	7.2	6.7	7.1	6.9	6.8	6.7	6.9	6.5	6.6	6.5	7.0	7.9	8.1	9.1	8.7	8.7	8.2	8.1	6.9	7.3	7.1	6.6	7.4	7.4
Cheyenne, Wyo.	11.9	12.1	12.7	12.5	12.8	13.3	12.7	12.4	13.1	12.5	14.3	15.0	17.6	15.8	16.2	16.5	15.4	14.5	12.5	11.7	12.3	13.1	12.6	11.8	13.6
Chicago, Ill.	19.2	19.0	18.8	18.5	18.3	18.5	19.0	18.5	17.6	18.3	17.5	17.7	17.3	17.3	17.4	17.5	17.1	17.6	18.4	18.1	18.5	19.1	19.4	19.2	18.2
Cincinnati, Ohio.	8.0	7.7	8.0	7.8	8.3	7.8	8.0	8.4	8.4	8.9	9.1	9.8	10.6	11.1	10.0	10.2	9.6	9.4	9.1	8.9	8.6	8.8	8.9	8.4	8.9
Cleveland, Ohio.	15.3	15.5	15.3	15.4	15.1	14.9	14.9	15.7	15.4	15.9	16.9	17.6	18.5	17.5	17.6	16.6	15.7	15.6	15.7	15.8	15.2	16.0	16.5	15.8	16.0
Columbia, Mo.	9.6	9.4	9.4	9.1	9.2	8.7	9.0	9.4	9.4	9.3	9.3	9.5	10.0	9.8	10.5	10.3	9.7	9.4	9.0	9.3	9.7	9.6	10.0	10.2	9.5
Columbus, Ohio.	7.9	7.6	7.4	7.6	8.0	8.0	7.9	7.9	7.9	8.7	9.5	9.9	10.4	10.0	10.1	9.2	9.1	8.5	8.6	8.4	8.8	8.6	8.4	8.2	8.6
Concordia, Kans.	5.4	5.7	5.5	5.5	5.2	5.6	5.8	5.4	4.7	5.0	6.0	6.6	7.8	8.3	8.3	7.7	7.3	6.1	5.5	5.9	6.0	6.2	6.3	6.2	6.2
Corpus Christi, Tex.	9.0	8.9	9.0	8.8	8.8	8.9	9.7	9.8	9.2	8.9	10.1	11.1	12.1	12.7	12.8	12.6	12.6	11.7	10.7	10.1	9.7	9.8	10.3	9.8	10.3
Davenport, Iowa.	7.6	7.8	7.2	7.1	6.9	6.6	7.1	7.2	7.3	7.3	7.7	7.8	8.9	8.8	9.0	8.9	8.5	7.9	7.8	8.2	7.9	8.0	7.7	7.7	7.8
Denver, Colo.	8.7	8.5	8.2	8.4	8.8	9.5	10.6	10.5	9.1	9.1	9.0	8.2	8.2	8.5	9.1	8.8	8.4	7.9	7.5	7.8	7.8	7.6	8.2	7.8	8.9
Des Moines, Iowa.	7.5	7.1	7.1	6.8	7.5	7.5	7.2	7.0	7.0	7.6	7.7	8.1	8.7	9.2	9.0	8.7	8.4	7.9	7.5	7.8	7.8	7.6	8.2	7.8	7.8
Detroit, Mich.	8.8	8.5	8.2	8.3	9.2	9.1	9.8	9.9	9.9	10.6	11.0	10.8	11.4	11.2	10.8	10.1	10.2	9.7	9.0	8.8	8.7	9.0	9.2	8.5	9.6
Dodge City, Kans.	9.0	9.3	9.1	8.8	8.9	9.2	9.4	8.8	9.2	10.2	12.3	13.6	14.8	14.7	15.8	14.4	14.5	12.0	9.3	8.3	8.2	7.7	7.3	7.4	10.5
Dubuque, Iowa.	6.5	7.2	6.4	6.3	6.3	6.3	6.7	6.8	7.3	7.6	7.9	7.7	8.7	9.0	9.0	8.5	8.0	7.4	7.6	7.4	7.0	7.5	7.2	6.7	7.4
Duluth, Minn.	11.5	12.5	11.8	9.6	8.9	8.4	9.0	9.2	8.6	8.1	8.4	8.1	7.8	7.5	8.1	7.7	7.9	7.7	8.4	8.5	9.4	9.7	8.7	10.4	9.0
Eastport, Me.	12.1	12.4	12.5	13.3	12.6	13.0	13.7	13.6	13.4	13.3	13.0	13.2	13.3	13.5	13.0	12.2	12.3	13.3	13.4	13.5	13.0	13.0	13.5	12.9	13.0
El Paso, Tex.	9.8	9.2	8.4	8.3	7.8	7.9	7.8	7.8	7.7	7.8	7.6	10.1	11.5	13.3	14.3	15.1	14.6	14.5	13.4	11.2	11.6	10.8	10.9	10.7	10.5
Erie, Pa.	12.3	12.6	12.3	13.0	12.6	12.6	13.1	13.3	13.2	14.4	14.4	14.9	15.3	14.4	14.4	14.2	13.5	12.9	12.8	12.8	12.4	12.0	12.3	11.6	13.2
Eureka, Cal.	5.0	4.9	4.5	4.9	5.0	4.9	5.4	5.6	5.2	5.8	5.9	4.6	4.6	5.4	5.9	7.2	8.3	8.0	7.5	6.4	5.6	5.6	5.7	5.3	5.7
Fort Canby, Wash.	20.4	20.6	20.5	21.2	20.9	20.7	22.4	23.0	21.3	20.7	20.9	20.3	20.4	21.8	22.0	23.4	23.9	24.0	21.9	21.9	22.2	22.5	21.0	19.5	21.6
Fort Smith, Ark.	5.9	6.1	6.4	6.5	6.5	6.8	6.6	7.0	7.8	8.2	8.3	8.3	8.7	8.9	9.2	9.3	8.7	7.2	6.5	6.1	6.5	6.8	7.1	6.8	7.3
Fresno, Cal.	3.2	3.1	3.3	3.2	3.8	3.5	2.7	2.9	2.7	3.3	3.0	2.9	3.5	4.6	4.9	4.7	4.4	3.7	3.1	2.6	2.9	3.0	2.9	2.9	3.4
Galveston, Tex.	11.1	11.5	11.1	10.9	11.1	11.2	11.1	11.6	11.9	11.8	12.4	12.4	13.0	12.3	12.5	12.7	12.9	12.0	11.9	11.3	12.3	12.5	12.0	11.5	11.9
Grand Haven, Mich.	11.7	11.7	12.2	12.3	12.4	12.2	12.1	11.7	11.3	11.3	12.0	12.2	11.8	11.2	11.5	11.7	11.4	11.7	12.0	11.9	11.5	11.1	10.7	10.7	11.7
Greenbay, Wis.	7.2	7.2	7.4	7.8	8.0	8.5	8.4	8.6	8.7	9.1	9.2	9.1	9.2	9.2	9.0	8.9	8.4	7.6	7.3	6.8	7.0	7.1	7.3	7.2	8.1
Hannibal, Mo.	9.1	8.6	9.8	9.9	9.4	9.4	8.7	9.0	9.4	9.8	10.0	10.4	11.0	10.5	10.8	11.0	10.2	9.3	8.8	8.8	9.2	9.7	9.0	9.2	9.6
Harrisburg, Pa.	6.6	6.5	6.3	6.3	6.3	6.9	7.0	7.0	8.1	8.4	9.4	10.1	10.7	9.9	9.4	9.1	8.5	8.3	8.2	8.3	7.9	7.6	7.5	7.1	8.0
Hatteras, N. C.	13.0	12.6	13.5	13.9	14.1	14.0	13.5	13.6	13.5	14.1	14.5	14.2	14.1	14.0	13.6	12.9	12.4	12.1	12.0	12.5	13.1	13.6	13.6	13.9	13.4
Havre, Mont.	10.5	11.5	12.2	12.1	13.0	13.4	13.6	13.6	13.3	13.0	12.5	12.9	14.3	14.6	14.1	14.3	13.3	13.0	12.2	11.5	11.3	10.9	10.8	11.0	12.6
Helena, Mont.	7.9	7.7	8.5	9.0	7.7	8.5	7.2	7.3	7.1	7.1	6.7	6.9	7.9	7.0	7.1	7.4	7.4	7.5	7.8	7.8	8.6	8.9	9.4	8.3	7.8
Huron, S. Dak.	10.0	9.6	9.0	9.4	8.8	8.4	8.9	9.6	9.2	8.9	9.1	9.1	10.1	9.5	9.2	8.9	8.4	8.8	9.5	10.1	10.8	10.8	10.5	10.0	9.4
Idaho Falls, Idaho.	7.9	7.7	8.1	7.5	7.6	7.5	7.0	7.3	8.0	8.5	7.5	8.3	8.6	8.8	8.8	9.2	8.7	7.9	7.7	7.8	7.3	6.9	7.0	6.8	7.9
Indianapolis, Ind.	11.1	10.9	10.1	10.5	11.3	11.0	11.2	11.0	11.1	11.5	12.1	12.1	12.2	12.3	11.9	11.4	11.2	10.3	9.9	10.9	11.5	11.6	11.4	11.2	11.2
Jacksonville, Fla.	5.5	5.1	5.4	5.8	5.5	5.5	5.4	5.1	5.8	6.2	8.8	10.3	11.6	12.4	11.9	11.6	11.1	10.5	9.3	8.3	8.1	8.4	8.4	8.5	9.3
Jupiter, Fla.	9.4	8.6	8.5	8.4	7.8	8.0	7.7	7.8	8.0	8.8	9.0	8.7	9.5	9.2	9.1	9.2	9.3	8.9	8.4	8.4	8.1	8.3	8.5	8.5	8.6
Kansas City, Mo.	8.2	8.1	8.0	8.2	8.5	8.4	8.2	8.0	8.1	8.7	9.0	8.7	9.5	9.2	9.1	9.2	9.3	8.6	8.1	7.6	8.1	8.2	7.8	7.7	8.1
Keokuk, Iowa.	8.3	7.4	7.5	7.5	7.4	7.5	7.9	7.6	7.4	8.1	8.2	8.6	8.8	8.9	9.0	9.3	8.6	8.1	7.6	8.1	8.2	7.8	7.8	7.7	8.1
Key West, Fla.	10.6	10.3	10.1	9.5	9.8	9.6	10.2	10.2	10.5	10.7	11.0	11.3	11.5	11.9	11.9	11.7	11.0	10.7	10.1	10.3	10.1	10.5	11.1	10.8	10.6
Kittyhawk, N. C.	12.6	12.4	12.4	12.0	11.4	12.2	12.1	12.4	12.6	14.1	14.9	14.2	14.7	14.6	14.0	12.8	12.5	12.3	12.3	12.7	13.3	14.2	14.6	14.0	13.2
Knoxville, Tenn.	7.0	7.5	7.5	7.4	7.4	7.3	7.6	7.6	7.7	7.5	8.0	8.1	9.1	9.0	8.4	8.0	7.8	7.5	6.8	6.6	6.6	6.4	7.0	7.1	7.5
La Crosse, Wis.	7.4	6.5	7.1	7.1	6.8	6.5	6.4	6.2	6.4	6.8	7.5	8.2	7.9	7.8	7.6	7.3	6.7	6.1	5.6	6.1	6.8	6.8	6.7	6.6	6.9
Lander, Wyo.	3.5	3.6	3.8	3.4	3.1	3.2	2.8	3.7	4.1	3.8	3.6	3.5	3.8	4.5	4.3	3.9	4.0	4.1	4.0	4.2	3.4	3.2	2.8	3.1	3.6
Lexington, Ky.	12.0	11.9	11.6	11.2	11.9	12.0	12.6	12.6	13.2	13.1	14.0	14.0	13.9	13.8	12.6	12.6	12.2	11.3	11.2	11.7	12.3	12.1	12.1	12.1	12.4
Little Rock, Ark.	6.6	6.8	6.5	6.9	7.1	6.4	6.8	6.9	7.0	7.5	8.4	8.4	9.9	9.7	10.3	10.6	10.5	9.1	8.4	8.0	7.2	7.7	7.3	6.5	7.9
Los Angeles, Cal.	2.8	3.1	3.4	3.7	4.1	3.9	3.6	3.9	4.0	4.4	4.0	4.0	4.3	4.0	4.1	4.3	4.8	5.3	6.0	5.2	3.5	2.4	2.5	2.8	3.9
Louisville, Ky.	8.3	8.6	8.7	8.5	8.7	8.8	8.6	8.4	8.9	9.5	10.0	10.7	11.3	10.6	10.5	10.6	9.6	8.9	9.1	9.6	9.4	9.1	9.0	8.7	9.3
Lynchburg, Va.	3.2	2.9	2.5	3.0	3.0	2.8	3.4	2.9	3.4	4.2	5.0	5.9	6.9	7.6	7.2	6.1	5.5	4.5	4.1	3.7	3.5	4.0	3.8	3.7	4.3
Marquette, Mich.	10.4	11.0	10.3	10.4	10.6	10.6	10.8	10.9	11.4	11.9	10.7	11.4	10.7	11.2	10.6	10.6	9.3	8.8	9.4	10.3	10.5	10.3	10.7	10.1	10.5
Memphis, Tenn.	11.1	11.1	10.3	10.0	9.8	9.2	9.4	9.8	9.7	10.6	11.5	11.3	11.6	10.3	10.3	10.7	10.4	10.0	9.5	11.0	11.0	10.7	11.0	11.4	10.5
Milwaukee, Wis.	11.3	11.5	11.2	10.9	11.0	10.9	10.9	10.6	10.7	11.0	11.2	11.4	11.5	11.6	11.3	11.3	11.3	10.5	10.6	10.9	10.7	10.3	10.2	11.2	11.0
Mobile, Ala.	5.9	5.1	5.4	6.0	6.2	6.0	5.5	5.2	6.2	6.5	7.0	7.7	8.7	9.1	9.3	9.6	9.3	8.0	7.0	6.8	7.3	7.5	7.1	6.7	7.0
Montgomery, Ala.	6.6	5.5	5.6	5.4	5.9	6.0	6.2	6.1	6.9	7.0	7.4	7.3	7.0	7.8	7.9	7.7	7.4	6.6	6.7	6.8	7.3	7.3	7.2	7.2	6.8
Moorhead, Minn.	9.0	9.1	9.0	8.3	8.0	7.9	7.8	7.9	8.0	8.3	8.7	9.2	9.5	9.7	9.9	9.4	8.8	8.7	7.7	8.3	8.7	8.7	8.5	8.3	8.6
Nantucket, Mass.																									
Nashville, Tenn.	6.2	6.7	6.8	6.5	6.4	6.8	7.5	7.2	6.7	7.1	8.0	8.0	8.2	8.8	8.4	8.5	8.4	8.1	7.9	7.6	8.2	7.3	7.1	7.3	7.5
New Haven, Conn.	8.6	8.5	7.6	7.5	8.0	7.8	7.5	7.7	8.1	8.7	10.4	11.1	11.7	11.3	11.0	10.6	10.0	9.3	9.1	9.0	8.5	8.4	8.5	8.1	9.0
New Orleans, La.	8.4	8.1	8.0	8.2	7.7	7.5	7.8	8.2	9.0	10.1	10.9	11.7	11.3	11.0	10.9	11.4	11.3	10.5	9.6	9.3	10.1	9.8	9.1	9.3	9.5
New York, N. Y.	11.5	11.3	11.3	11.4	11.2	10.5	11.5	11.5	11.9	11.8	12.2	12.4	12.5	13.3	13.3	13.4	13.5	13.7	13.9	13.5	12.6	12.5	12.1	12.0	12.3
Norfolk, Va.	8.4	8.4	8.4	8.2	7.6	7.3	7.4	7.9	8.6	9.0	9.5	9.7	10.4	10.4	9.7	9.5	8.0	6.6	7.3	7.7	8.1	8.2	8.5	8.4	8.5
Northfield, Vt.	8.8	7.7	7.7	8.5	8.1	7.7	6.9	6.8	7.0	7.8	8.5	9.4	10.0	10.5	10.5	9.5	8.7	9.3	9.9	9.7	8.8	8.6	9.5	9.3	8.7
North Platte, Nebr.	8.1	7.8	7.5	7.8	8.5	8.3	8.8	8.9	8.8	9.3	9.9	9.3	10.3	10.6	12.4	11.6	10.8	9.0	8.0	7.1	6.8	6.6	6.6	7.4	8.8
Oklahoma, Okla.	9.8	10.0	9.7	9.8	10.5	10.1	10.4	10.5	9.7	10.3	11.3	12.0	13.1	13.0	13.3	12.7	12.2	11.0	9.6	9.6	9.6	9.0	9.4	9.8	10.7
Omaha, Nebr.	7.3	7.3	6.9	6.9	6.8	6.7	6.4	6.7	7.3	7.4	7.8	8.1	8.5	8.6	8.1	8.6	8.5	8.5	8.2	8.1	8.0	7.9	7.2	7.2	7.6
Oswego, N. Y.	13.0	12.4	11.9	11.9	12.1	12.2	12.0	11.8	12.3	12.1	13.0	12.4	13.4	13.3	13.1	13.3	13.3	13.4	14.3	14.6	15.4	15.1	15.0	14.3	13.1
Palestine, Tex.	5.7	6.0	6.2	6.5	6.5	6.4	6.2	6.7	6.9	7.4	7.8	8.3	8.7	9.2	9.4	9.5	9.0	8.5	6.4	6.0	6.2	5.6	5.8	5.8	7.1
Parkersburg, W. Va.	3.5	3.8	4.0	3.7	3.8	7.3	4.1	4.0	4.2	4.5	4.5	4.6	5.5	5.2	4.9	4.9	4.3	4.0	4.0	4.2	4.1	3.7	3.8	3.9	4.2

TABLE VII.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Pensacola, Fla.	9.0	8.6	8.1	8.1	8.4	8.4	7.8	8.5	8.1	8.9	9.1	9.5	8.9	9.7	10.0	10.1	9.6	8.7	7.6	7.0	6.8	7.4	7.5	8.9	8.5
Philadelphia, Pa.	8.4	8.3	8.4	8.6	8.9	8.4	8.6	9.5	9.7	10.8	11.1	11.7	13.0	13.0	13.1	12.5	10.9	10.2	10.1	9.9	10.1	9.5	10.0	9.4	10.2
Phœnix, Ariz.	2.4	2.7	2.9	3.0	2.9	3.3	3.1	2.9	2.7	2.9	2.7	3.3	3.7	3.8	3.9	4.1	4.1	3.5	3.2	2.6	2.3	2.9	2.5	2.5	3.1
Pierre, S. Dak.	6.2	6.5	6.6	6.7	6.5	6.1	6.0	6.6	5.9	6.1	6.5	7.0	8.0	8.7	8.5	8.4	8.0	7.5	6.9	6.0	6.0	6.2	6.2	5.7	6.8
Pittsburg, Pa.	7.2	7.3	7.1	7.2	7.0	7.3	7.7	7.8	7.8	7.9	8.5	8.6	8.9	8.8	8.4	8.3	7.9	7.8	7.7	7.1	7.2	6.8	6.5	6.8	7.7
Port Angeles, Wash.	4.8	4.9	5.2	4.8	4.4	4.5	4.7	4.4	4.7	4.4	3.9	3.8	4.0	3.3	3.7	3.9	4.5	5.1	4.7	4.8	4.8	4.3	4.6	4.7	4.5
Port Huron, Mich.	10.7	10.9	11.0	10.8	10.9	11.4	12.1	11.8	12.7	13.1	13.4	13.2	13.6	13.2	13.5	12.2	11.6	10.4	10.0	10.3	10.8	10.8	10.7	10.2	11.6
Portland, Me.	6.6	6.6	6.7	6.8	6.7	6.9	7.4	7.0	6.9	7.0	7.1	7.5	7.4	7.3	7.1	7.0	6.8	7.1	7.1	6.9	7.0	7.4	7.7	7.1	7.0
Portland, Oreg.	10.2	11.0	11.3	11.6	11.4	11.0	10.4	10.3	10.6	11.6	11.1	10.7	10.8	11.3	11.5	12.2	11.7	10.9	10.6	11.1	11.4	11.2	12.6	11.9	11.2
Pueblo, Colo.	5.0	5.1	4.8	4.8	4.7	5.2	6.3	6.7	6.0	6.5	6.8	7.0	7.3	8.7	9.4	9.4	10.3	9.6	7.7	5.4	5.3	5.4	5.5	5.1	6.6
Raleigh, N. C.	4.9	5.4	5.4	5.5	4.5	4.8	4.8	4.8	5.4	5.9	6.7	6.8	7.3	7.3	6.7	6.5	5.8	4.8	4.9	5.5	5.6	5.5	5.6	5.6	5.7
Rapid City, S. Dak.	7.6	7.8	7.9	7.5	7.9	8.0	7.8	6.8	7.7	8.1	7.5	7.0	8.1	8.8	9.8	10.0	9.1	8.2	7.8	6.6	6.8	7.6	7.7	7.3	7.9
Redbluff, Cal.	4.5	4.9	4.7	4.8	4.6	4.3	4.9	4.6	4.6	5.0	5.6	5.4	5.7	6.4	6.7	7.0	6.5	6.5	6.1	5.2	5.4	5.8	5.1	5.2	5.4
Rochester, N. Y.	7.9	8.0	7.9	7.3	7.1	7.2	7.9	7.8	8.4	9.1	9.8	10.2	11.0	10.4	10.4	9.4	9.6	8.9	9.2	8.8	8.3	8.1	8.2	8.3	8.7
Roseburg, Oreg.	2.3	2.7	2.3	2.6	2.3	2.5	2.8	3.2	3.0	3.1	2.9	2.7	2.8	3.7	3.7	4.0	4.0	4.4	3.8	3.5	3.5	3.0	2.5	2.3	3.1
Sacramento, Cal.	6.7	6.5	6.5	6.8	6.6	6.5	6.1	5.9	6.3	6.4	6.1	6.1	6.5	7.3	7.9	8.1	8.3	7.5	7.5	6.9	6.8	6.8	6.5	6.3	6.8
St. Louis, Mo.	9.2	9.3	9.2	9.6	10.3	10.4	10.5	10.0	9.9	10.1	10.5	10.5	9.6	9.5	9.9	9.8	10.3	9.8	9.7	9.6	9.2	9.7	9.8	9.4	9.8
St. Paul, Minn.	7.1	7.3	7.2	7.3	7.2	7.0	7.4	7.6	7.8	7.6	8.0	7.8	8.3	8.0	8.5	9.0	8.4	8.1	7.5	7.2	6.8	6.7	6.6	7.1	7.6
Salt Lake City, Utah.	4.0	4.0	4.5	4.5	5.0	4.5	4.1	4.3	4.5	4.5	4.5	4.6	5.0	5.2	6.0	5.8	6.0	5.9	4.9	4.1	4.1	3.5	3.5	3.8	4.6
San Antonio, Tex.	8.0	7.7	7.3	7.4	8.4	7.6	7.7	8.1	8.0	8.2	8.5	9.7	10.5	11.7	11.3	11.1	11.5	10.9	9.3	8.5	8.6	7.9	8.0	7.8	8.9
San Diego, Cal.	4.5	5.1	5.0	4.8	4.4	4.0	3.8	4.1	4.7	4.3	4.0	3.0	3.6	4.9	6.5	8.3	9.5	9.6	8.0	6.5	5.3	4.6	4.5	4.7	5.3
Sandusky, Ohio.	8.9	8.5	8.3	8.2	8.2	8.3	8.8	9.1	9.6	10.1	10.1	10.5	11.1	11.3	11.3	10.2	9.5	9.3	8.8	8.7	9.1	9.0	9.1	8.9	9.4
San Francisco, Cal.	5.6	5.7	5.8	4.9	5.9	5.7	6.0	6.2	6.2	7.2	7.8	7.3	8.5	8.0	7.8	7.5	7.6	7.7	7.6	7.6	7.5	6.5	5.9	5.3	6.7
San Luis Obispo, Cal.	3.5	3.3	3.3	3.5	3.6	3.0	3.7	3.1	2.8	3.4	3.7	3.6	4.7	4.7	5.7	7.3	7.5	7.6	6.5	5.7	4.9	4.6	3.9	3.7	4.5
Santa Fe, N. Mex.	7.1	7.2	6.6	7.2	6.7	7.2	6.7	6.4	7.2	7.3	7.3	9.2	9.7	9.6	10.3	9.7	8.6	7.5	5.3	4.2	4.8	5.7	6.0	6.7	7.3
Sault Ste Marie, Mich.	8.2	8.0	8.5	8.6	8.4	8.3	8.3	8.6	9.4	9.2	9.0	9.1	9.0	9.0	9.1	8.7	7.9	8.6	9.1	9.5	8.9	9.0	8.7	9.0	8.8
Savannah, Ga.	7.4	6.9	6.6	6.6	6.8	6.8	6.8	6.8	7.2	7.5	7.6	7.8	8.3	7.8	7.4	7.9	7.4	7.0	6.6	6.8	7.1	7.2	7.8	8.4	7.3
Seattle, Wash.	8.3	8.3	7.7	7.5	6.8	7.0	7.1	6.4	6.3	6.8	6.6	6.9	6.9	7.3	7.2	7.5	8.0	7.8	7.8	7.5	8.2	7.8	7.5	7.4	7.3
Shreveport, La.	7.0	7.1	8.0	7.6	7.7	7.8	8.1	7.7	7.6	8.2	8.5	9.1	10.1	10.3	10.2	10.3	10.2	9.7	8.6	7.8	8.0	8.0	7.7	7.9	8.5
Sioux City, Iowa.	10.9	10.6	10.5	11.4	11.3	10.4	10.3	11.0	10.5	10.5	10.7	10.5	11.2	11.5	12.5	12.8	12.5	10.9	10.6	10.2	10.6	10.9	11.2	11.2	11.0
Spokane, Wash.	6.3	6.5	6.4	6.5	6.0	5.2	5.4	4.9	5.2	5.9	5.5	5.3	5.7	6.0	6.8	7.1	6.5	6.7	5.7	5.9	5.1	5.2	5.7	5.9	5.9
Springfield, Ill.	9.7	9.7	9.6	9.5	9.7	9.7	10.5	10.0	10.3	10.6	10.6	10.8	10.6	10.7	10.8	11.3	10.9	9.8	10.2	10.5	10.1	10.4	10.1	10.2	10.3
Springfield, Mo.	11.1	10.8	10.2	10.2	10.0	10.0	10.3	9.9	10.5	10.9	11.6	11.3	12.1	12.3	12.0	12.4	11.6	11.5	11.4	11.4	11.3	12.1	11.5	11.7	11.2
Tacoma, Wash.	7.1	7.8	6.7	6.7	6.2	5.6	5.3	5.4	5.2	4.6	4.8	5.2	6.0	6.6	6.6	6.8	7.6	7.2	7.5	7.3	7.2	7.5	6.7	7.0	6.4
Tampa, Fla.	5.0	4.8	5.1	4.7	4.5	4.3	4.9	4.6	5.0	5.9	6.8	7.1	7.8	7.7	7.7	7.4	6.6	5.7	5.7	5.6	5.3	5.0	4.9	4.9	5.7
Tatoosh Island, Wash.	16.8	17.1	17.7	17.3	17.8	17.8	18.2	18.4	17.6	17.2	17.3	17.7	17.5	19.4	18.4	18.0	18.2	18.4	18.2	18.8	17.8	17.3	18.0	17.7	17.9
Toledo, Ohio.	9.3	9.5	8.9	8.9	9.6	9.9	10.9	10.8	10.7	11.2	11.6	12.2	12.9	13.0	12.5	12.5	11.5	10.5	10.5	10.4	10.1	9.7	10.1	9.9	10.7
Vicksburg, Miss.	7.3	7.4	7.2	7.7	7.9	7.6	7.7	7.7	8.1	8.4	9.1	9.0	9.2	8.3	9.1	9.4	9.5	7.7	7.3	7.7	7.8	8.6	7.8	7.8	8.1
Vineyard Haven, Mass.	9.9	9.9	9.9	10.1	9.5	9.6	9.2	9.0	9.8	9.7	10.2	10.1	10.7	11.2	11.2	10.8	9.9	9.9	10.5	9.8	9.4	9.7	9.6	10.1	10.0
Walla Walla, Wash.	6.6	5.9	6.0	5.8	5.4	5.2	4.9	5.4	5.9	5.9	6.2	6.5	6.5	6.6	7.4	6.7	6.4	6.0	5.5	5.2	5.5	5.9	6.0	6.1	6.0
Washington, D. C.	5.2	5.1	4.5	4.6	5.2	5.3	5.3	5.0	6.5	8.1	8.9	9.3	9.5	9.7	9.8	9.4	7.8	6.9	6.3	6.1	6.4	6.0	6.4	5.8	6.8
Wichita, Kans.	9.8	9.6	9.2	9.1	8.7	8.7	8.6	8.0	8.5	8.5	9.9	10.5	11.5	11.0	10.9	11.3	10.9	9.9	8.4	8.6	8.2	8.6	8.4	8.7	9.4
Williston, N. Dak.	6.8	6.8	7.0	7.1	6.9	7.6	7.7	6.7	6.4	6.2	6.3	5.8	7.5	9.3	11.1	11.7	11.7	11.2	9.0	9.0	9.7	9.5	8.9	8.0	8.2
Wilmington, N. C.	6.1	6.5	6.6	7.2	7.3	6.8	7.2	7.0	7.1	7.6	8.5	8.2	8.7	8.5	8.5	7.9	7.2	6.3	6.3	6.1	6.5	6.6	6.3	6.0	7.1
Woods Hole, Mass.	18.1	17.6	17.8	16.9	16.6	17.6	17.3	17.5	17.4	16.5	16.2	16.3	16.8	16.6	16.6	16.6	16.2	16.2	17.4	16.7	16.8	16.1	16.9	17.5	16.9
Yankton, S. Dak.	8.0	7.6	7.5	7.7	7.8	7.3	7.3	7.3	6.5	6.6	7.8	8.7	9.0	9.6	9.5	8.8	8.3	7.8	7.7	7.8	7.8	8.3	8.1	8.0	7.9

TABLE VIII.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of December, 1897.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	23	12	9	32	n. 64 w.	26
Portland, Me	26	15	2	35	n. 72 w.	35
Northfield, Vt	17	37	3	10	s. 19 w.	21
Boston, Mass	18	15	5	35	n. 84 w.	30
Nantucket, Mass	23	18	9	29	n. 76 w.	21
Woods Hole, Mass.*	8	13	8	13	s. 45 w.	7
Block Island, R. I	24	11	14	30	n. 51 w.	21
New Haven, Conn	32	7	10	26	n. 33 w.	30
Middle Atlantic States.						
Albany, N. Y	21	26	8	18	s. 63 w.	11
Binghamton, N. Y.†	7	7	10	11	w.	1
New York, N. Y	19	15	14	28	n. 74 w.	15
Harrisburg, Pa	13	22	21	22	s. 6 w.	9
Philadelphia, Pa	24	15	14	26	n. 55 w.	16
Atlantic City, N. J	24	16	8	28	n. 68 w.	22
Baltimore, Md	15	13	14	30	n. 83 w.	16
Washington, D. C	26	20	9	17	n. 53 w.	10
Lynchburg, Va	19	20	10	32	s. 87 w.	22
Norfolk, Va	24	21	14	19	n. 59 w.	6
South Atlantic States.						
Charlotte, N. C	16	25	19	13	s. 34 e.	11
Hatteras, N. C	31	10	7	22	n. 35 w.	26
Kittyhawk, N. C.						
Raleigh, N. C	26	21	8	21	n. 69 w.	14
Wilmington, N. C	23	11	12	26	n. 49 w.	18
Charleston, S. C	28	13	12	23	n. 36 w.	19
Augusta, Ga	16	16	10	33	w.	23
Savannah, Ga	22	18	13	20	n. 60 w.	8
Jacksonville, Fla	25	11	14	26	n. 41 w.	18
Florida Peninsula.						
Jupiter, Fla	19	15	20	31	n. 70 w.	12
Key West, Fla	21	8	35	2	n. 69 e.	36
Tampa, Fla	34	7	14	16	n. 4 w.	27
Eastern Gulf States.						
Atlanta, Ga	16	13	16	27	n. 75 w.	11
Pensacola, Fla	23	21	18	13	n. 68 e.	5
Mobile, Ala	25	21	12	16	n. 45 w.	6
Montgomery, Ala	17	19	17	23	s. 72 w.	6
Vicksburg, Miss	21	20	20	17	n. 72 e.	3
New Orleans, La	18	23	18	17	s. 11 e.	5
Western Gulf States.						
Shreveport, La	19	20	19	20	s. 45 w.	1
Fort Smith, Ark	13	8	24	25	n. 11 w.	5
Little Rock, Ark	15	19	13	27	s. 74 w.	15
Corpus Christi, Tex	31	17	14	11	n. 10 e.	17
Galveston, Tex	28	20	9	15	n. 37 w.	10
Palestine, Tex	23	25	13	16	s. 56 w.	4
San Antonio, Tex	31	18	10	15	n. 21 w.	14
Ohio Valley and Tennessee.						
Chattanooga, Tenn	15	27	17	22	s. 23 w.	13
Knoxville, Tenn	23	22	14	23	n. 84 w.	9
Memphis, Tenn	19	20	16	21	s. 79 w.	5
Nashville, Tenn	15	25	12	23	s. 48 w.	15
Lexington, Ky	9	22	14	27	s. 45 w.	18
Louisville, Ky	15	26	14	21	s. 32 w.	13
Indianapolis, Ind	20	22	10	24	s. 82 w.	14
Cincinnati, Ohio	17	20	17	26	s. 72 w.	10
Columbus, Ohio	14	18	13	31	s. 77 w.	18
Pittsburg, Pa	7	29	13	28	s. 34 w.	27
Parkersburg, W. Va	16	26	12	24	s. 50 w.	16
Lower Lake Region.						
Buffalo, N. Y	11	18	14	30	s. 66 w.	18
Oswego, N. Y	10	33	16	18	s. 5 w.	23
Rochester, N. Y	5	30	10	31	s. 40 w.	33
Erie, Pa	8	26	10	29	s. 47 w.	26
Cleveland, Ohio	8	30	8	31	s. 46 w.	32
Sandusky, Ohio	11	15	17	40	s. 80 w.	23
Toledo, Ohio	8	19	12	35	s. 64 w.	26
Detroit, Mich	13	20	8	35	s. 74 w.	26
Upper Lake Region.						
Alpena, Mich	9	15	11	34	s. 76 w.	25
Grand Haven, Mich	24	13	20	22	n. 5 w.	11
Marquette, Mich	18	18	2	35	w.	33
Port Huron, Mich	12	28	6	31	s. 57 w.	30
Sault Ste. Marie, Mich	17	16	25	15	n. 84 e.	10
Chicago, Ill	19	17	9	30	n. 85 w.	21
Milwaukee, Wis	18	12	6	36	n. 79 w.	31
Upper Lake Region—Cont'd.						
Greenbay, Wis	17	24	1	32	s. 77 w.	32
Duluth, Minn	19	20	3	37	s. 88 w.	34
North Dakota.						
Moorhead, Minn	17	22	17	26	s. 61 w.	10
Bismarck, N. Dak	24	14	17	23	n. 31 w.	12
Williston, N. Dak	23	17	4	29	n. 77 w.	26
Upper Mississippi Valley.						
St. Paul, Minn	23	21	8	31	n. 85 w.	23
La Crosse, Wis.†	10	12	4	12	s. 76 w.	8
Davenport, Iowa	30	11	15	30	n. 59 w.	18
Des Moines, Iowa	29	11	19	21	n. 6 w.	18
Dubuque, Iowa	22	17	9	30	n. 77 w.	22
Keokuk, Iowa	25	16	15	21	n. 34 w.	11
Cairo, Ill	19	24	10	22	s. 67 w.	13
Springfield, Ill	20	18	9	26	n. 83 w.	17
Hannibal, Mo.†	10	7	6	15	n. 72 w.	10
St. Louis, Mo	24	20	12	22	n. 68 w.	11
Missouri Valley.						
Columbia, Mo.*	12	8	10	9	n. 14 e.	4
Kansas City, Mo	33	12	10	28	n. 41 w.	28
Springfield, Mo	22	18	17	21	n. 45 w.	6
Lincoln, Nebr	24	19	13	20	n. 54 w.	9
Omaha, Nebr	32	15	7	24	n. 45 w.	24
Sioux City, Iowa†	15	8	9	7	n. 16 e.	7
Pierre, S. Dak	19	16	20	21	n. 18 w.	3
Huron, S. Dak	25	18	15	21	n. 41 w.	9
Yankton, S. Dak†	11	6	7	9	n. 22 w.	5
Northern Slope.						
Havre, Mont	11	24	7	40	s. 69 w.	36
Miles City, Mont	8	33	6	25	s. 37 w.	31
Helena, Mont	21	22	1	37	s. 72 w.	3
Rapid City, S. Dak	23	7	11	39	n. 60 w.	32
Cheyenne, Wyo	30	11	3	36	n. 9 w.	19
Lander, Wyo	10	32	15	25	s. 24 w.	24
North Platte, Nebr	18	13	6	39	n. 81 w.	33
Middle Slope.						
Denver, Colo	15	32	4	21	s. 45 w.	24
Pueblo, Colo	23	14	17	24	n. 38 w.	11
Concordia, Kans	19	20	12	21	s. 84 w.	9
Dodge City, Kans	28	14	7	24	n. 27 w.	16
Wichita, Kans	30	16	11	21	n. 36 w.	17
Oklahoma, Okla	33	15	8	17	n. 28 w.	19
Southern Slope.						
Abilene, Tex	29	21	6	19	n. 58 w.	15
Amarillo, Tex	24	16	14	16	n. 14 w.	8
Southern Plateau.						
El Paso, Tex	29	3	14	32	n. 35 w.	32
Santa Fe, N. Mex	26	19	23	6	n. 45 e.	24
Phœnix, Ariz	22	5	23	25	n. 7 w	17
Yuma, Ariz	34	3	14	12	n. 4 e.	31
Middle Plateau.						
Carson City, Nev	17	24	10	24	s. 63 w.	16
Winnemucca, Nev	19	22	8	16	s. 69 w.	8
Salt Lake City, Utah	13	32	23	17	s. 18 e.	20
Northern Plateau.						
Baker City, Oreg	12	33	18	15	s. 8 e.	21
Idaho Falls, Idaho	31	22	3	9	n. 34 w.	11
Spokane, Wash	16	25	18	17	n. 6 e.	9
Walla Walla, Wash	6	32	12	21	s. 19 w.	28
North Pacific Coast Region.						
Fort Canby, Wash	10	21	27	8	s. 60 e.	22
Port Angeles, Wash.*	3	13	11	10	s. 18 w.	3
Seattle, Wash	14	31	29	4	s. 56 e.	30
Tacoma, Wash	9	33	17	15	s. 5 e.	24
Tatoosh Island, Wash	2	24	33	8	s. 49 e.	33
Portland, Oreg	14	28	24	7	s. 51 e.	22
Roseburg, Oreg	10	28	17	17	s.	18
Middle Pacific Coast Region.						
Eureka, Cal	14	23	22	19	s. 18 e.	10
Redbluff, Cal	35	12	9	17	n. 19 w.	24
Sacramento, Cal	35	14	21	5	n. 37 e.	26
San Francisco, Cal	36	9	7	23	n. 31 w.	31
South Pacific Coast Region.						
Fresno, Cal	24	9	18	23	n. 18 w.	16
Los Angeles, Cal	28	5	13	28	n. 33 w.	28
San Diego, Cal	34	5	24	20	n. 8 e.	29
San Luis Obispo, Cal	38	8	4	19	n. 27 w.	34

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE IX.—*Thunderstorms and auroras, December, 1897.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	....	1	....	....	....	....	....	....	....	1	1	1	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11	5	T.
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Arizona	52	T.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
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Arkansas	61	T.	....	....	....	....	....	....	....	....	....	3	....	....	4	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	3	T.
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California	181	T.	5	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	3	T.
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Colorado	75	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Connecticut	14	T.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	1	1	T.
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Delaware	3	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Dist. of Columbia	4	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Florida	45	T.	....	....	....	....	....	....	....	....	....	....	....	....	5	3	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	9	3	T.
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Georgia	62	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Idaho	30	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Illinois	92	T.	....	....	....	....	....	....	....	....	2	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	T.
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Indiana	54	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Indian Territory	7	T.	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	3	T.
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Iowa	122	T.	....	....	....	....	....	....	....	....	7	....	....	....	....	....	....	....	....	....	....	5	2	....	....	....	....	....	....	....	....	....	....	7	2	T.
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Kansas	85	T.	....	....	....	....	....	1	1	....	1	....	....	....	....	....	....	1	....	....	....	2	....	....	....	....	....	....	....	....	....	1	....	6	2	T.
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Kentucky	52	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	50	T.	2	....	2	1	....	....	1	....	....	7	....	3	4	....	1	....	....	1	....	2	1	....	....	....	....	....	....	....	1	....	....	26	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	14	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Maryland	35	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
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Massachusetts	24	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Michigan	112	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Minnesota	69	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Mississippi	46	T.	1	1	4	....	....	....	....	....	....	3	....	1	4	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	7	T.
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Missouri	95	T.	....	....	1	....	....	....	....	7	3	....	....	....	....	....	....	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	5	T.
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Montana	37	T.	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	T.
		A.	1	1	....	....	....	....	....	....	....	1	1	....	....	....	....	1	....	....	1	2	1	2	1	1	....	1	1	2	....	1	2	20	16	A.
Nebraska	143	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Nevada	48	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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New Hampshire	14	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	5	....	1	....	....	....	....	....	....	....	....	7	3	T.
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New Jersey	55	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
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New Mexico	39	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
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New York	103	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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North Carolina	59	T.	1	....	....	....	....	....	....	....	....	....	....	....	2	8	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12	4	T.
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North Dakota	46	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	1	....	....	4	....	1	....	....	....	....	....	1	1	....	....	10	7	A.
Ohio	135	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	....	....	....	....	5	5	A.
Oklahoma	23	T.	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oregon	62	T.	....	....	....	....	1	3	14	1	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Pennsylvania	105	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
Rhode Island	5	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Carolina	43	T.	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	44	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	1	4	....	....	....	....	....	....	....	1	1	1	....	10	7	A.
Tennessee	65	T.	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	85	T.	....	1	....	....	....	....	....	2	2	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	6	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	41	T.	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	13	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	1	....	....	....	....	....	....	....	3	2	A.
Virginia	49	T.	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	50	T.	....	....	....	....	....	3	5	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	35	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	5	1	A.
Wisconsin	61	T.	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	T.
		A.	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	1	....	4	....	1	1	....	....	....	....	....	....	....	....	9	6	A.
Wyoming	14	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	2	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2,810	T.	11	4	7	1	2	6	29	4	27	24	3	6	30	13	3	10	1	2	1	2	1	0	1	0	0	0	0	1	1	1	11	192	....	T.
		A.	2	3	3	1	0	3	3	2	2	3	1	2	0	1	1	1	2	2	5	40	27	9	4	3	0	8	3	9	4	3	3	145	....	A.

TABLE X.—*Hourly sunshine as deduced from sunshine recorders, December, 1897.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours.*		
Albany, N. Y	T.	.....	.....	.....	16	20	27	39	44	38	32	26	25	20	.....	.....	.....	83.7	281.0	30	23
Atlanta, Ga	T.	.....	.....	17	26	27	34	37	40	43	41	32	28	25	33	.....	.....	102.6	307.7	33	28
Atlantic City, N. J	P.	.....	.....	.....	45	44	48	50	49	54	53	50	59	34	.....	.....	.....	144.6	293.7	49	39
Baltimore, Md	T.	.....	.....	.....	22	36	58	68	73	76	69	55	39	28	.....	.....	.....	157.9	293.7	54	42
Binghamton, N. Y	T.	.....	.....	.....	7	13	26	36	45	41	38	31	14	6	.....	.....	.....	78.1	284.7	27	23
Bismarck, N. Dak	P.	.....	.....	.....	46	43	45	43	45	45	54	53	52	53	.....	.....	.....	126.4	265.6	48	45
Boston, Mass	T.	.....	.....	.....	36	39	50	60	55	50	53	46	31	30	.....	.....	.....	131.8	284.7	46	36
Buffalo, N. Y	T.	.....	.....	.....	0	5	14	22	36	37	36	26	18	10	.....	.....	.....	61.4	281.0	22	12
Charleston, S. C	T.	.....	.....	16	23	30	46	43	57	49	43	47	38	39	67	.....	.....	128.3	310.7	41	43
Chattanooga, Tenn	T.	.....	.....	9	9	11	21	31	30	35	35	30	28	16	.....	.....	.....	75.7	305.2	25	26
Cheyenne, Wyo	P.	.....	.....	.....	47	53	62	65	58	65	60	64	57	50	.....	.....	.....	169.2	287.8	59	51
Chicago, Ill	T.	.....	.....	.....	29	13	30	35	37	42	41	27	21	29	.....	.....	.....	86.7	284.7	30	31
Cincinnati, Ohio	T.	.....	.....	.....	26	26	33	35	40	41	43	39	35	27	.....	.....	.....	102.8	293.7	35	29
Cleveland, Ohio	T.	.....	.....	.....	6	10	10	7	8	12	12	6	6	8	.....	.....	.....	24.7	284.7	9	9
Columbus, Ohio	T.	....	.....	.....	6	6	18	22	24	20	16	11	11	10	.....	.....	.....	43.1	291.7	15	31
Denver, Colo	P.	.....	.....	.....	57	56	65	74	72	73	74	68	68	77	.....	.....	.....	199.6	291.7	68	55
Des Moines, Iowa	T.	.....	.....	.....	41	48	50	55	56	52	53	53	53	39	.....	.....	.....	144.9	284.7	51	48
Detroit, Mich	T.	.....	.....	.....	11	15	27	38	40	44	37	31	17	8	.....	.....	.....	80.9	284.7	28	29
Dodge City, Kans	P.	.....	.....	64	54	68	74	77	78	77	75	72	69	64	.....	.....	.....	211.4	296.7	71	64
Dubuque, Iowa	T.	.....	.....	.....	11	17	35	48	61	63	52	42	35	33	.....	.....	.....	116.8	284.7	41	41
Eastport, Me	P.	.....	.....	.....	37	38	51	50	45	42	44	31	25	21	.....	.....	.....	107.8	274.3	39	32
Erie, Pa	T.	.....	.....	.....	3	4	7	13	19	22	15	12	9	3	.....	.....	.....	32.3	284.7	11	18
Eureka, Cal	P.	.....	.....	.....	34	43	59	61	62	59	61	56	49	37	.....	.....	.....	153.4	287.8	53	49
Fresno, Cal	T.	.....	.....	50	51	54	69	80	81	84	80	79	72	63	.....	.....	. ...	214.9	299.4	72	67
Galveston, Tex	P.	.....	.....	25	35	45	48	46	49	42	47	47	45	35	41	.....	.....	139.6	330.2	44	42
Harrisburg, Pa	T.	.....	.....	.....	10	17	44	55	61	59	57	47	27	20	.....	.....	.....	120.0	291.7	41	27
Helena, Mont	P.	.....	.....	.....	18	15	31	45	45	53	52	54	21	19	. ....	.....	.....	101.2	265.6	38	39
Huron, S. Dak	T.	.....	.....	....	22	26	45	54	58	53	49	37	26	29	.....	.....	....	115.5	277.7	42	37
Idaho Falls, Idaho	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	281.0	.....	34
Indianapolis, Ind	T.	.....	.....	.....	11	14	25	35	36	36	27	22	16	17	.....	.....	.....	65.2	291.7	22	19
Jacksonville, Fla	T.	.....	.....	27	34	46	63	68	75	76	80	68	55	42	48	.....	.....	190.8	317.8	60	50
Kansas City, Mo	P.	.....	.....	.....	11	24	38	45	41	46	47	39	31	34	.....	.....	.....	105.9	293.7	36	30
Key West, Fla	T.	.....	.....	50	58	59	66	70	78	85	83	79	67	63	60	.....	.....	230.1	339.1	70	55
Knoxville, Tenn	T.	.....	.....	6	10	18	28	38	35	42	39	37	33	31	.....	.....	.....	94.2	302.5	31	26
Little Rock, Ark	T.	.....	.....	36	26	25	41	48	52	53	50	41	35	35	.....	.....	.....	124.5	305.2	41	29
Los Angeles, Cal	P.	.....	.....	78	84	84	88	87	85	89	84	86	77	88	100	.....	.....	262.1	307.7	85	79
Louisville, Ky	T.	.....	.....	0	13	15	18	35	37	35	31	19	18	12	.....	.....	.....	70.2	296.7	24	17
Minneapolis, Minn	T.	.....	.....	.....	23	27	34	38	37	47	46	36	25	25	.....	.....	.....	96.4	274.3	35	.....
Nashville, Tenn	T.	.....	.....	33	17	19	25	27	39	36	30	31	21	18	.....	.....	.....	80.9	302.5	27	21
New Orleans, La	T.	.....	.....	30	29	45	55	66	70	73	67	59	50	38	52	.....	.....	173.3	317.8	55	55
New York, N. Y	T.	.....	.....	.....	21	37	46	55	56	58	61	53	32	28	.....	.....	.....	133.1	287.8	46	38
Northfield, Vt	P.	.....	.....	.....	28	30	32	33	38	26	27	28	21	17	.....	.....	.....	79.6	277.7	29	28
Oklahoma, Okla	T.	.....	.....	73	44	44	55	61	67	67	68	61	55	53	.....	....	.....	175.9	305.2	58	54
Omaha, Nebr	P.	.....	.....	.....	38	29	45	43	37	34	44	43	33	33	.....	.....	.....	109.7	287.8	38	37
Parkersburg, W. Va	T.	.....	.....	.....	11	15	23	26	28	25	21	18	10	7	.....	.....	.....	55.7	293.7	19	17
Philadelphia, Pa	T.	.....	.....	.....	31	35	43	52	61	59	55	54	49	43	.....	.....	.....	142.0	291.7	49	33
Phœnix, Ariz	P.	.....	.....	56	69	93	95	94	87	91	95	92	84	77	100	.....	.....	271.4	310.7	87	74
Pittsburg, Pa	T.	.....	.....	.....	3	6	12	18	30	37	28	16	3	0	.....	.....	.....	47.2	287.8	16	16
Portland, Me	T.	.....	.....	.....	16	27	40	45	47	45	41	35	35	24	.....	.....	.....	103.6	277.7	37	35
Portland, Oreg	T.	.....	.....	.....	12	14	27	30	39	39	36	27	25	19	.....	.....	.....	76.5	269.6	28	28
Portland, Oreg	P.	.....	.....	.....	12	15	23	27	29	34	31	24	23	19	.....	.....	.....	66.7	269.6	25	28
Raleigh, N. C	T.	.....	.....	6	3	25	46	55	56	55	55	54	39	30	.....	.....	.....	125.1	302.5	41	40
Rochester, N. Y	T.	.....	.....	.....	1	5	11	25	26	22	18	13	7	3	.....	.....	.....	40.3	281.0	14	12
St. Louis, Mo	T.	.....	.....	.....	12	17	23	36	38	45	38	36	27	14	.....	.....	.....	86.6	293.7	29	19
St. Paul, Minn	P.	.....	.....	.....	36	36	39	44	47	51	48	39	36	37	.....	.....	.....	115.1	274.3	42	44
Salt Lake City, Utah	P.	.....	.....	.....	42	32	37	45	49	55	57	63	54	41	.....	.....	.....	137.5	287.8	48	50
San Diego, Cal	P.	.....	.....	80	88	89	90	94	91	86	88	86	83	82	100	.....	.....	272.5	310.7	88	79
San Francisco, Cal	T.	.....	.....	36	19	56	79	81	81	81	86	85	74	54	.....	.....	.....	210.3	296.7	71	55
Santa Fe, N. Mex	P.	.....	.....	67	65	76	85	86	80	87	89	88	85	62	.....	.....	.....	244.2	302.5	81	72
Savannah, Ga	P.	.....	.....	42	43	43	54	52	49	44	51	55	51	43	50	.....	.....	152.2	313.0	49	44
Seattle, Wash	T.	.....	.....	.....	0	1	3	8	9	6	13	9	0	0	.....	.....	.....	15.3	262.1	6	19
Spokane, Wash	T.	.....	.....	.....	2	4	10	13	16	20	23	18	10	12	.....	.....	.....	35.7	262.1	14	17
Tacoma, Wash	T.	.....	.....	.....	2	3	4	13	21	24	13	13	13	13	.....	.....	.....	33.4	265.6	13	13
Tampa, Fla	T.	.....	.....	57	52	47	63	67	66	65	55	59	50	58	55	.....	.....	187.4	322.9	58	57
Vicksburg, Miss	T.	.....	.....	18	30	34	43	45	45	47	49	42	39	28	50	.....	.....	122.6	313.0	39	37
Washington, D. C	P.	.....	.....	.....	31	37	52	58	58	54	56	60	45	40	.....	.....	.....	146.1	293.7	50	51
Wilmington, N. C	T.	.....	.....	22	19	42	50	60	68	62	59	54	45	21	.....	.....	.....	147.9	307.7	48	45
Yankton, S. Dak	T.	.....	.....	.....	22	40	53	60	64	65	50	35	31	26	.....	.....	.....	131.1	281.0	47	41

TABLE XI.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during December, 1897, at all stations furnished with self-registering gauges.*

Stations.	Date.	Total duration.		Total amt of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.												
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.*																					
Atlanta, Ga.	2			0.52														0.12			
Atlantic City, N. J.	14-15			1.46														0.28			
Baltimore, Md.	14-15			1.30														0.17			
Binghamton, N. Y.	4-5			0.75														0.13			
Bismarck, N. Dak.*																					
Boston, Mass.	14-15			2.20														0.21			
Buffalo, N. Y.	14-15			2.17														0.31			
Cairo, Ill.*	10			0.27														0.16			
Charleston, S. C.	25-26			1.61														0.28			
Chicago, Ill.*	4			0.23														0.17			
Cincinnati, Ohio*	13-14			0.33														0.11			
Cleveland, Ohio*	11			0.21														0.11			
Columbus, Ohio	10-11			0.47														0.24			
Denver, Colo.*																					
Des Moines, Iowa	3-4			1.06														0.12			
Detroit, Mich.	10-11			0.54														0.20			
Dodge City, Kans.*																					
Duluth, Minn.*																					
Eastport, Me.*																					
Erie, Pa.*																					
Fresno, Cal.	7-8			0.25																	
Galveston, Tex.	10			0.52														0.07			
Harrisburg, Pa.	4-5			1.04														0.49			
Hatteras, N. C.	2-3	8.35 p. m.	11.55 a. m.	3.35	11.03 a. m.	11.55 a. m.	2.15	0.07	0.12	0.18	0.27	0.35	0.47	0.60	0.72	0.95	1.11	1.20			
Huron, S. Dak.*																					
Idaho Falls, Idaho*																					
Indianapolis, Ind.*	3-4			0.37														0.11			
Jacksonville, Fla.	13-14			1.65														0.78			
Jupiter, Fla.	14			0.31												0.31					
Kansas City, Mo.*																					
Key West, Fla.	14	8.52 a. m.	10.40 a. m.	1.15	9.06 a. m.	9.36 a. m.	0.05	0.20	0.32	0.50	0.78	0.86	1.05								
Knoxville, Tenn.	20-21			0.98														0.23			
Lincoln, Nebr.*																					
Little Rock, Ark.	10			1.06														0.50			
Los Angeles, Cal.	14			0.02																	
Louisville, Ky.*	30-31			0.76														0.17			
Memphis, Tenn.	19-20			1.32														0.17			
Milwaukee, Wis.*																					
Montgomery, Ala.	13	6.15 a. m.	4.00 p. m.	1.58	11.28 a. m.	12.05 p. m.	0.89	0.09	0.12	0.27	0.37	0.47	0.55	0.60	0.65						
Nantucket, Mass.	15			0.69														0.20			
Nashville, Tenn.	19-20			1.90														0.45			
New Orleans, La.	1-2			1.23														0.46			
New York, N. Y.	14-15			2.15														0.35			
Norfolk, Va.	14			1.43													0.52				
Northfield, Vt.*																					
Oklahoma, Okla.*																					
Omaha, Nebr.	19-20			0.22														0.04			
Parkersburg, W. Va.	30-31			0.58														0.15			
Philadelphia, Pa.	14			2.02														0.28			
Pittsburg, Pa.*																					
Portland, Me.	14-15			1.65														0.25			
Portland, Oreg.	6-7			0.99														0.16			
Raleigh, N. C.	14			0.40												0.22					
Rochester, N. Y.	14-15			0.99														0.20			
St. Louis, Mo.	3			0.55														0.18			
St. Paul, Minn.	6			0.10														0.04			
Salt Lake City, Utah	1-2			0.31														0.09			
San Diego, Cal.	18			0.09																	
San Francisco, Cal.	7			1.02														0.21			
Savannah, Ga.	25-26			1.46														0.22			
Seattle, Wash.	12-13			2.89														0.53			
Spokane, Wash.*																					
Tampa, Fla.	13-14			1.68														0.50			
Vicksburg, Miss.	2-3	9.24 a. m.	7.38 p. m.	5.75	3.10 a. m.	4.15 a. m.	1.42	0.05	0.09	0.14	0.24	0.29	0.46	0.66	0.85	0.95	1.01	1.16	1.31	1.47	1.54
Washington, D. C.	14			1.14														0.29			
Wilmington, N. C.	11-12			0.91														0.41			
Yankton, S. Dak.*																					

*Record incomplete on account of snow.

TABLE XII.—*Excessive precipitation, by stations, for December, 1897.*

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Hamilton	11.20	2.90	2	.....	.....	.....
Healing Springs	.....	2.70	13	.....	.....	.....
Jasper	12.13	5.57	2-3	.....	.....	.....
Mobile	.....	.....	.....	1.92	0 45	13
Newburg	.....	2.71	2-3	.....	.....	.....
Pineapple	.....	2.75	13	.....	.....	.....
Arkansas.						
Elon	.....	3.77	2-3	.....	.....	.....
Fayetteville	.....	2.80	9-10	.....	.....	.....
Fort Smith	.....	2.66	16-17	.....	.....	.....
Lonoke	.....	3.00	19	.....	.....	.....
Winslow	.....	4.40	9-10	.....	.....	.....
California.						
Bowmans Dam	.....	3.25	7-8	.....	.....	.....
Crescent City	10.66	2.67	6	.....	.....	.....
Fordyce Dam	.....	2.67	11	.....	.....	.....
Fort Ross	.....	4.23	7	.....	.....	.....
Georgetown	.....	3.60	7-8	.....	.....	.....
Iowa Hill	.....	2.50	8	.....	.....	.....
Peachland	.....	2.83	7	.....	.....	.....
Pilot Creek	.....	2.76	8	.....	.....	.....
Summerdale	.....	3.17	7-8	.....	.....	.....
Upper Matole	.....	2.88	4-5	.....	.....	.....
Connecticut.						
Canton	.....	3.37	14	.....	.....	.....
Colchester	.....	3.33	14-15	.....	.....	.....
New Haven	.....	3.21	14-15	.....	.....	.....
Norwalk	.....	2.94	14-15	.....	.....	.....
Southington	.....	4.25	14-15	.....	.....	.....
Storrs	.....	3.88	14-15	.....	.....	.....
Voluntown	.....	3.56	14-15	.....	.....	.....
Waterbury	.....	3.29	14-15	.....	.....	.....
Windsor	.....	3.79	14-15	.....	.....	.....
Florida.						
Carrabelle	.....	3.10	25	.....	.....	.....
Jacksonville	.....	2.89	25	.....	.....	.....
Key West	.....	.....	.....	1.09	1 00	14
Louisiana.						
Alexandria	13.59	4.37	3	.....	.....	.....
Amite	.....	2.50	2	.....	.....	.....
Bastrop	.....	3.44	2-3	.....	.....	.....
Baton Rouge	.....	3.65	1	.....	.....	.....
Donaldsonville	.....	2.75	2	.....	.....	.....
Franklin	.....	2.97	2-3	.....	.....	.....
Do	.....	2.55	11	.....	.....	.....
Hammond	10.81	6.79	1-2	.....	.....	.....
Jeanerette	.....	3.00	1	.....	.....	.....
Lake Charles	.....	3.48	2-3	.....	.....	.....
Liberty Hill	10.17	.....	.....	.....	.....	.....
Monroe	10.92	3.92	3	.....	.....	.....
New Iberia	.....	3.05	2	.....	.....	.....
Oakridge	12.39	2.80	3	.....	.....	.....
Paincourtville	.....	3.40	1-2	.....	.....	.....
Robeline	14.60	3.60	3	.....	.....	.....
Sugartown	.....	2.55	18	.....	.....	.....
White Hall	.....	4.77	1-2	.....	.....	.....
White Sulphur Springs	12.93	3.00	4	.....	.....	.....
Do	.....	2.69	17-18	.....	.....	.....
Massachusetts.						
Amherst	.....	3.00	14-15	.....	.....	.....
Fitchburg	.....	2.92	14-15	.....	.....	.....
Framingham	.....	2.90	14-15	.....	.....	.....
Groton	.....	3.03	14-15	.....	.....	.....
Springfield Armory	.....	3.12	14-15	.....	.....	.....
Westboro	.....	3.07	14-15	.....	.....	.....
Worcester	.....	3.60	14-15	.....	.....	.....
Mississippi.						
Agricultural College	11.72	7.39	2-3	.....	.....	.....
Canton	12.28	4.25	3	.....	.....	.....
Columbus	12.81	7.70	2-3	.....	.....	.....
Edwards	14.78	7.24	3	.....	.....	.....
Fayette	.....	2.60	4	.....	.....	.....
French Camps	10.83	3.26	3	.....	.....	.....
Greenville	.....	2.60	2-3	.....	.....	.....
Jackson	11.86	8.21	2-3	.....	.....	.....
Logtown	.....	2.67	1-2	.....	.....	.....
Louisville	12.91	7.68	2-3	.....	.....	.....
Natchez	.....	2.50	3	.....	.....	.....
Okolona	.....	2.54	2-3	.....	.....	.....
Palo Alto	11.05	5.56	3	.....	.....	.....
Do	.....	3.78	21	.....	.....	.....
Port Gibson	11.70	5.29	2-3	.....	.....	.....
Vicksburg	13.27	5.28	2-3	1.24	1 00	3
Walnut Grove	13.85	5.66	3	.....	.....	.....
Yazoo City	11.22	3.67	2-3	.....	.....	.....
Missouri.						
Birchtree	.....	2.67	16-17	.....	.....	.....
Phillipsburg	.....	2.70	10	.....	.....	.....
Springfield	.....	2.56	10	.....	.....	.....
New Hampshire.						
Concord	.....	2.50	14-15	.....	.....	.....

TABLE XII.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
New Jersey.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Asbury Park	.....	2.52	14	.....	.....	.....
Beverly	.....	2.85	14-15	.....	.....	.....
Charlotteburg	.....	2.63	14-15	.....	.....	.....
Freehold	.....	2.51	14-15	.....	.....	.....
Gillette	.....	2.75	14-15	.....	.....	.....
Moorestown	.....	2.79	14	.....	.....	.....
Oceanic	.....	3.18	14	.....	.....	.....
Paterson	.....	2.57	14	.....	.....	.....
Perth Amboy	.....	2.73	14	.....	.....	.....
Port Norris	.....	2.70	14	.....	.....	.....
Rancocas	.....	2.50	14	.....	.....	.....
Somerville	.....	2.52	14-15	.....	.....	.....
Staffordville	.....	2.60	14	.....	.....	.....
Toms River	.....	2.96	14-15	.....	.....	.....
Vineland	.....	3.19	14-15	.....	.....	.....
New York.						
Catskill	.....	2.61	14-15	.....	.....	.....
Setauket	.....	4.34	14-15	.....	.....	.....
North Carolina.						
Beaufort	.....	4.06	14-15	.....	.....	.....
Hatteras	.....	3.35	2-3	1.20	0 55	3
Pantego	.....	3.17	13-14	.....	.....	.....
Southport	.....	2.70	13-14	.....	.....	.....
Willeyton	.....	2.55	14	.....	.....	.....
Oregon.						
Astoria	16.05	2.58	26-27	.....	.....	.....
Bay City	37.42	4.06	7	.....	.....	.....
Do	.....	15.96	24-28	.....	.....	.....
Cascade Locks	19.26	.....	.....	.....	.....	.....
Falls City	21.96	3.03	7	.....	.....	.....
Forest Grove	14.61	.....	.....	.....	.....	.....
Gardiner	11.97	.....	.....	.....	.....	.....
Glenora	42.21	9.20	5-7	.....	.....	.....
Do	.....	3.65	10	.....	.....	.....
Do	.....	5.75	13	.....	.....	.....
Do	.....	6.00	24-25	.....	.....	.....
Do	.....	9.69	27-28	.....	.....	.....
Government Camp	17.09	.....	.....	.....	.....	.....
Hood River (near)	12.54	.....	.....	.....	.....	.....
Langlois	11.23	.....	.....	.....	.....	.....
McMinnville	11.33	.....	.....	.....	.....	.....
Nehalem	21.74	2.36	4	.....	.....	.....
Do	.....	6.70	26-27	.....	.....	.....
Newberg	12.15	.....	.....	.....	.....	.....
Stafford	12.18	.....	.....	.....	.....	.....
Toledo	14.15	.....	.....	.....	.....	.....
Vernonia	14.32	.....	.....	.....	.....	.....
Rhode Island.						
Bristol	.....	2.66	14-15	.....	.....	.....
Providence	.....	2.92	14-15	.....	.....	.....
Tennessee.						
Rugby	.....	2.60	19-20	.....	.....	.....
Texas.						
Colmesneil	11.02	2.65	22	.....	.....	.....
Jasper	.....	2.90	6	.....	.....	.....
Washington.						
Aberdeen	18.66	3.30	12	.....	.....	.....
Ashford	17.31	.....	.....	.....	.....	.....
Cascade Tunnel	17.43	2.62	12	.....	.....	.....
Do	.....	5.60	25-27	.....	.....	.....
Chehalis	14.27	.....	.....	.....	.....	.....
Clearwater	23.66	3.66	13	.....	.....	.....
Do	.....	4.26	27	.....	.....	.....
Fort Canby	14.11	.....	.....	.....	.....	.....
Grandmound	16.59	2.56	13	.....	.....	.....
Do	.....	3.22	27	.....	.....	.....
Lacenter	12.09	.....	.....	.....	.....	.....
Madrone	13.92	2.60	13	.....	.....	.....
Mayfield	12.83	2.75	27	.....	.....	.....
Northbend	22.62	3.70	13	.....	.....	.....
Do	.....	8.49	26-28	.....	.....	.....
Olympia	17.60	2.62	27	.....	.....	.....
Port Angeles	.....	2.63	13	.....	.....	.....
Pysht	18.98	3.10	12-13	.....	.....	.....
Do	.....	3.95	26-27	.....	.....	.....
Seattle	11.80	2.94	12-13	.....	.....	.....
Snohamish	10.58	.....	.....	.....	.....	.....
Southbend	20.70	4.00	13	.....	.....	.....
Do	.....	3.39	27	.....	.....	.....
Stampede	12.09	.....	.....	.....	.....	.....
Tacoma	14.48	2.87	12-13	.....	.....	.....
Do	.....	2.90	27-28	.....	.....	.....
Tatoosh Island	17.50	2.78	12-13	.....	.....	.....
Do	.....	3.10	26-27	.....	.....	.....
Union City	29.20	3.93	13	.....	.....	.....
Do	.....	6.81	27	.....	.....	.....
Vashon	15.17	2.87	13	.....	.....	.....
Do	.....	2.68	27	.....	.....	.....

Chart I. Tracks of Centers of High Areas

Chart I. Tracks of Centers of High Areas. December, 1897.

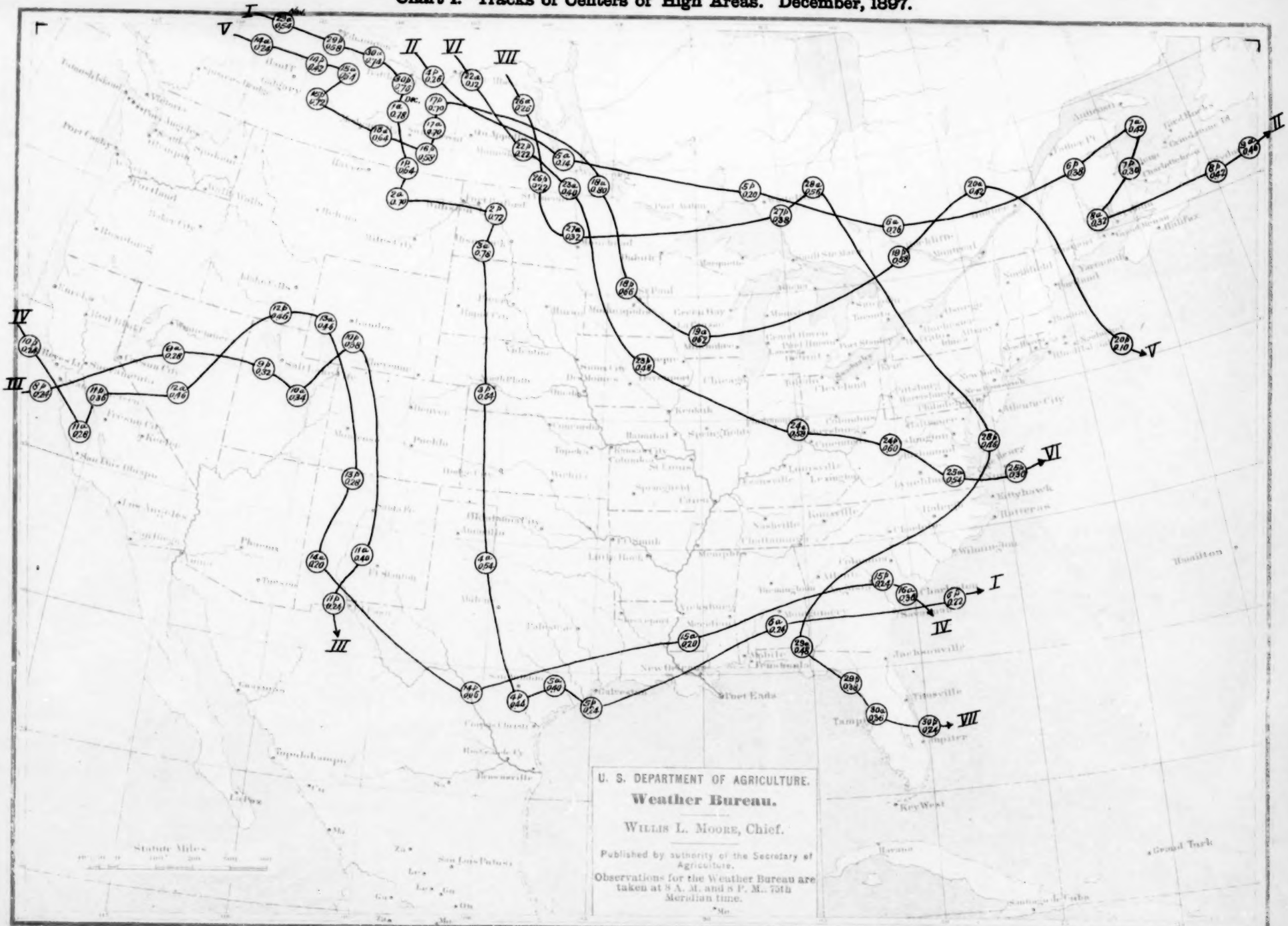


Chart II. Tracks of Centers of Low Areas. December, 1897.

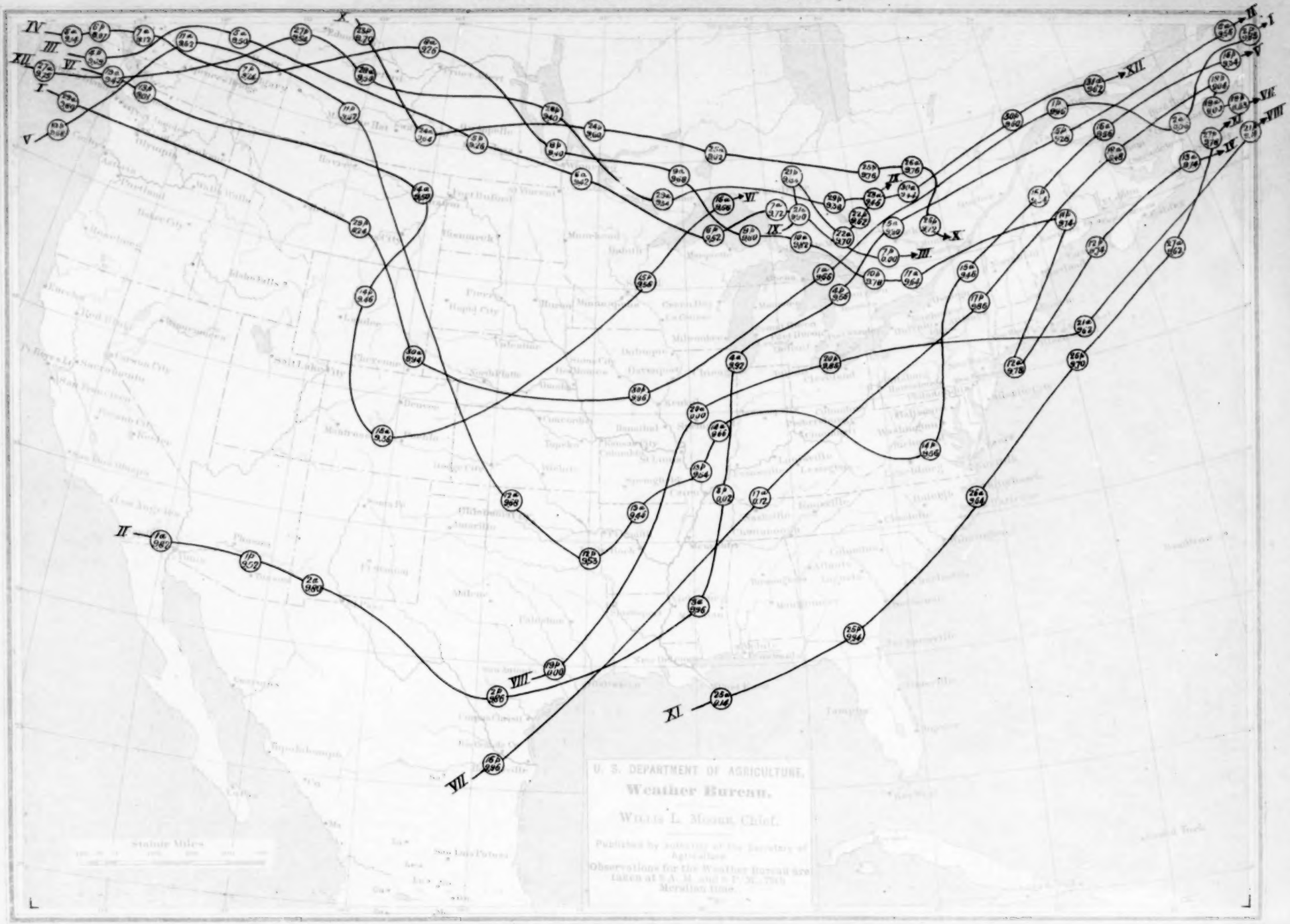


Chart III. Total Precipitation. December, 1897.

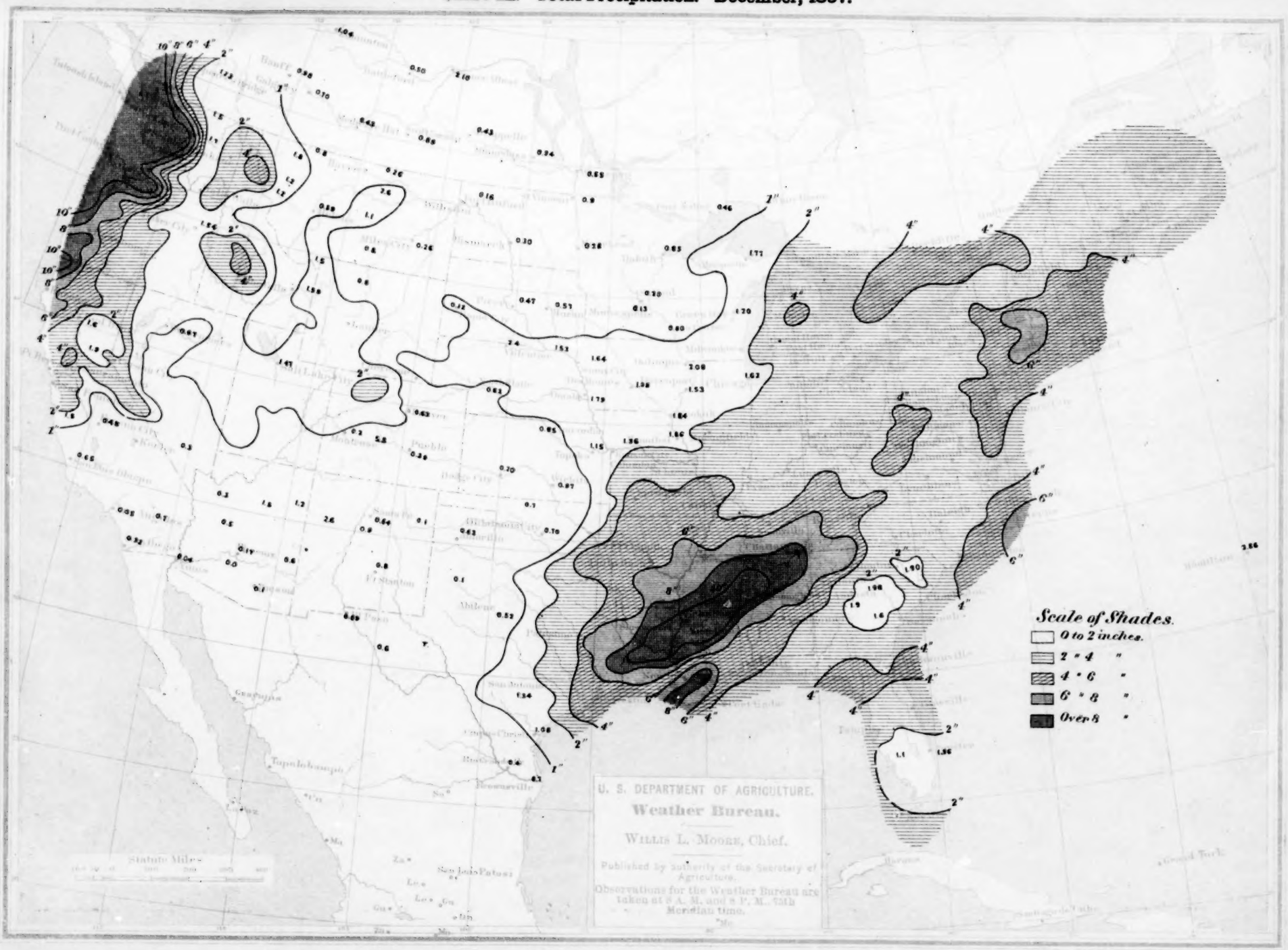

Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
Willis L. Moore, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles

Chart IV. Isobars, Isotherms, and Resultant Winds. December, 1897.

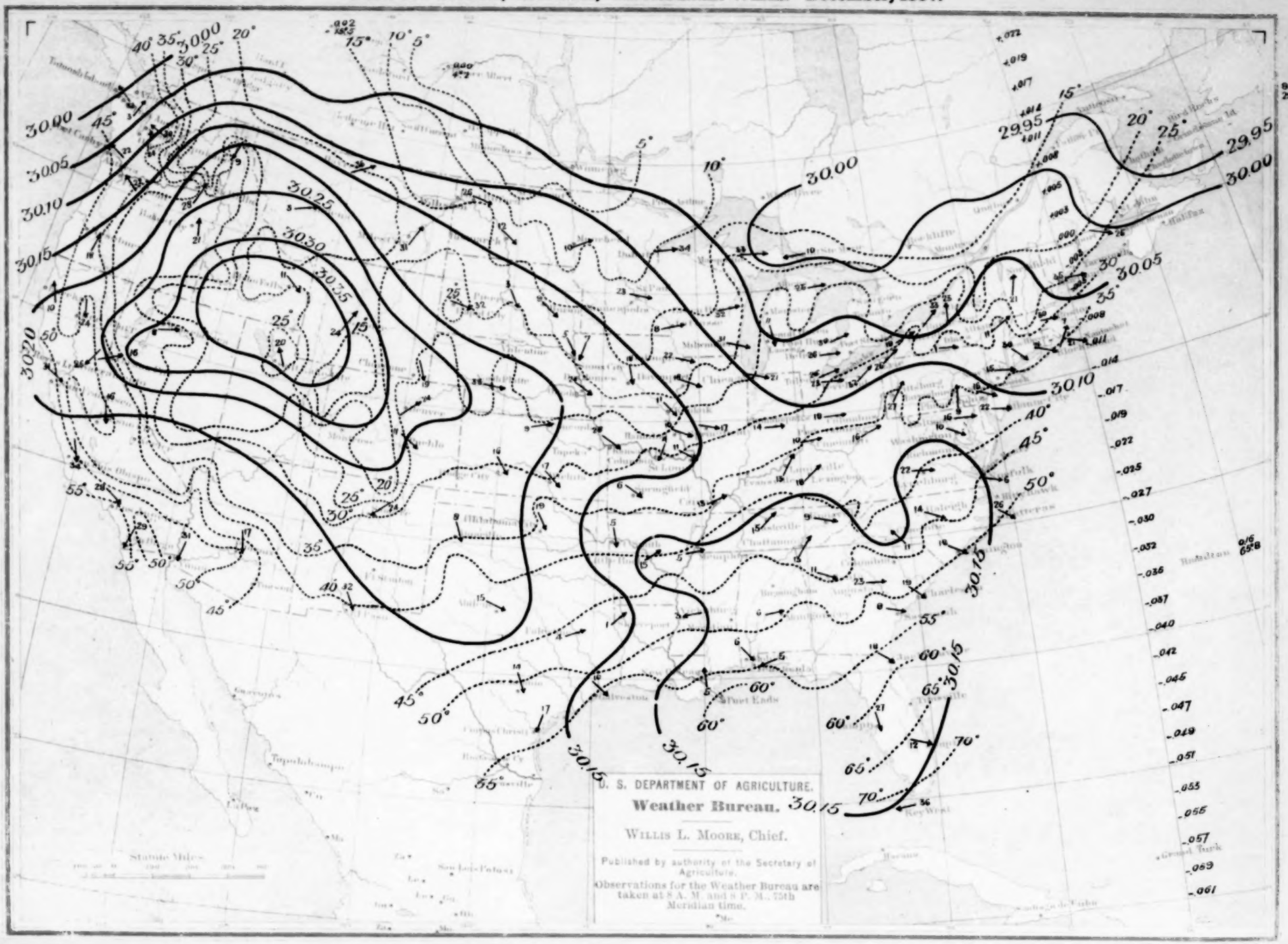

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart V. Hydrographs for Seven Principal Rivers of the United States. December, 1897.

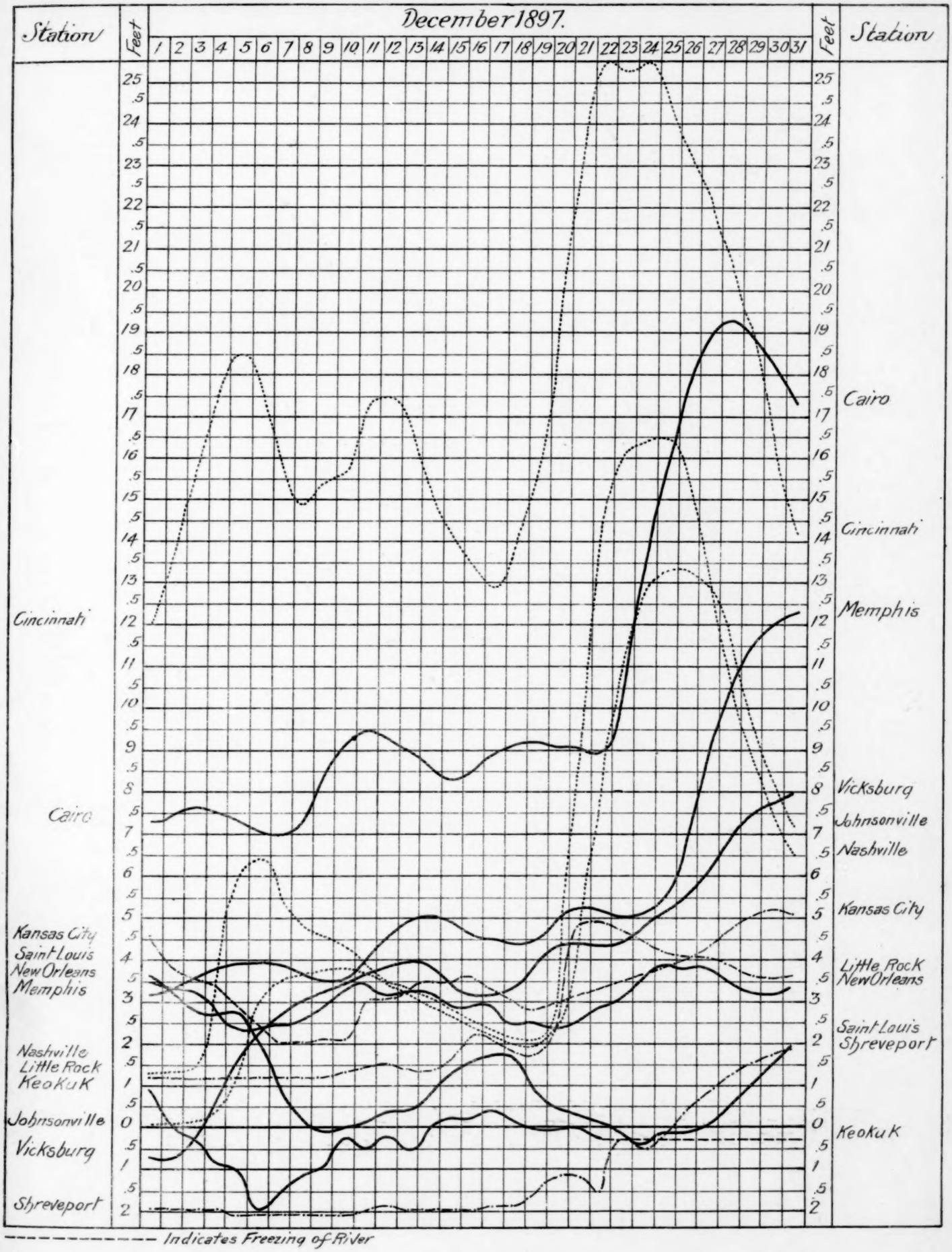

December 1897.
Station
Feet
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
25 .5 24 .5 23 .5 22 .5 21 .5 20 .5 19 .5 18 .5 17 .5 16 .5 15 .5 14 .5 13 .5 12 .5 11 .5 10 .5 9 .5 8 .5 7 .5 6 .5 5 .5 4 .5 3 .5 2 .5 1 .5 0 .5 1 .5 2
Cincinnati
Cairo
Kansas City
Saint Louis
New Orleans
Memphis
Nashville
Little Rock
Keokuk
Johnsonville
Vicksburg
Shreveport
Cairo
Cincinnati
Memphis
Vicksburg
Johnsonville
Nashville
Kansas City
Little Rock
New Orleans
Saint Louis
Shreveport
Keokuk
Indicates Freezing of River

Chart VI. Total Snowfall (inches) and Limits of Freezing Weather, December 1897

Chart VI. Total Snowfall (inches) and Limits of Freezing Weather. December, 1897.

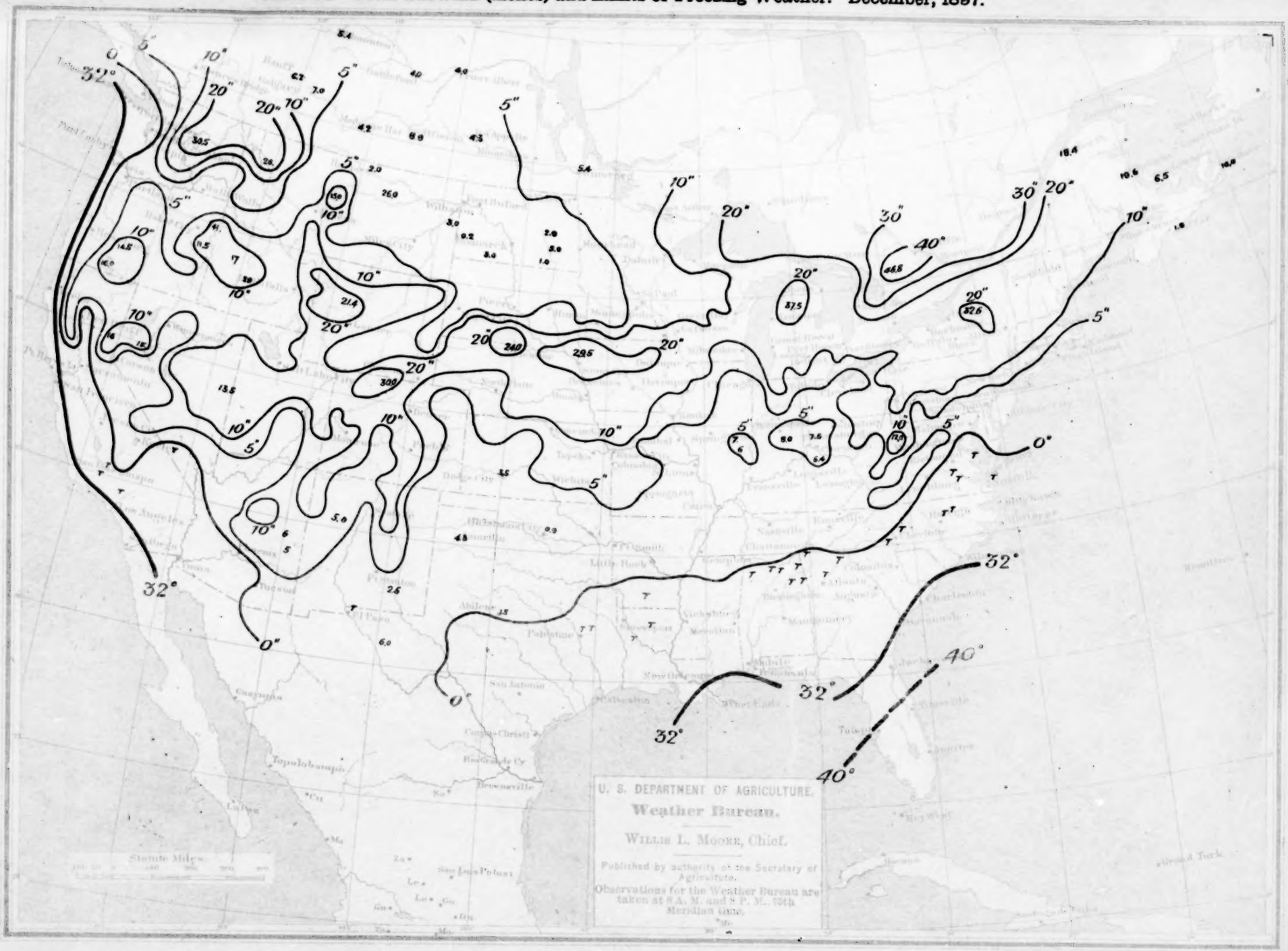
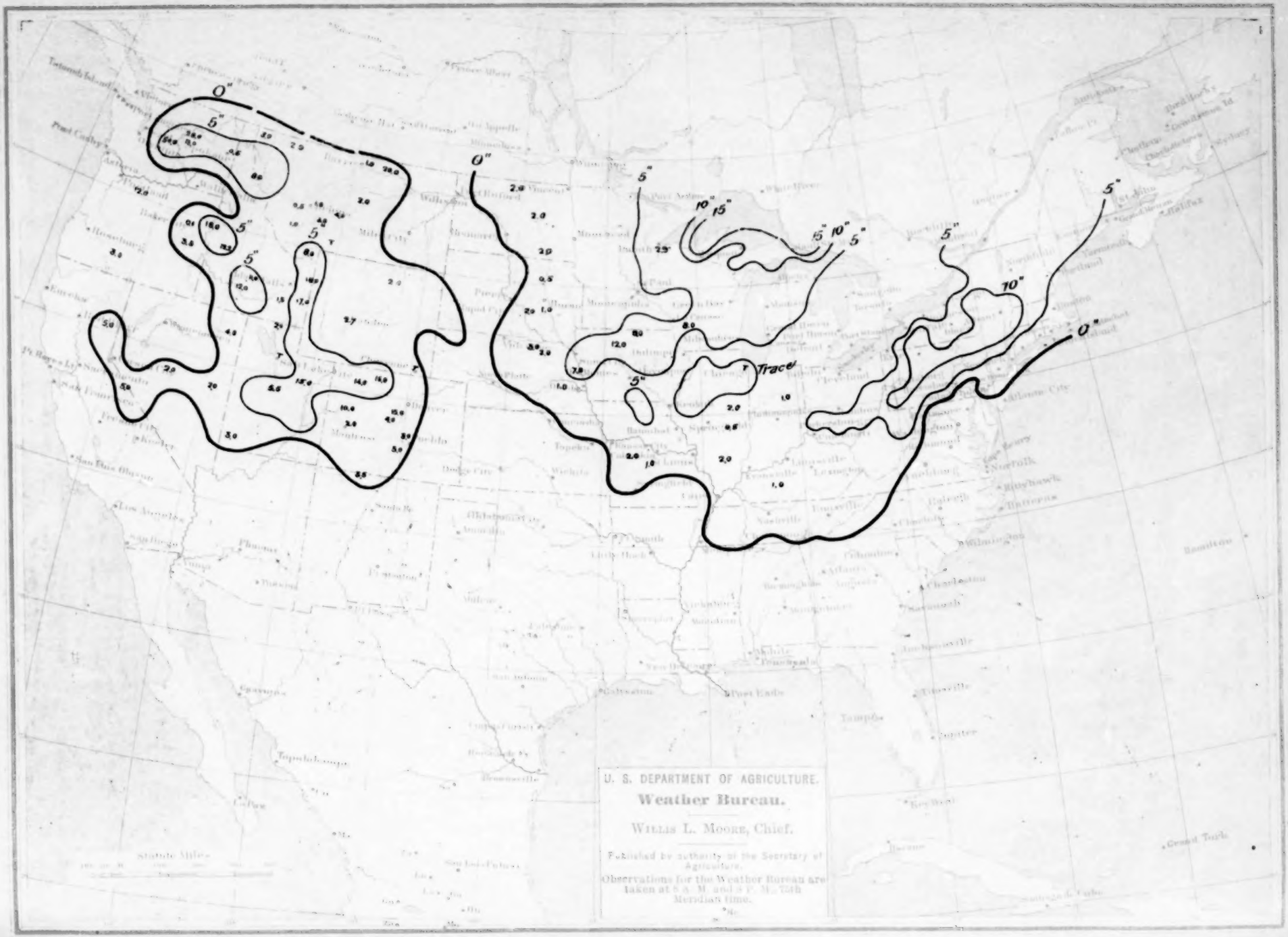


Chart VII. Depth of Snow on Ground at the Close of the Month. December, 1897.


0"
5"
10"
15"
Trace
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M. 75th Meridian time.